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Assessment of Maintenance Practices for Education Building Facilities: A Case Study of University of Hail

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by

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Assessment of Maintenance Practices for Education Building Facilities: A Case Study of University of Hail

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University of Hail, College of Engineering, Department of Architectural Engineering

2025

Declaration

I, Khaled Msned Alrashidi, hereby declare that the work presented in this research report has not been submitted for any other degree or professional qualification, and that it is the result of my own independent work.

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Abstract

Assessment of Maintenance Practices for Education Building Facilities: A Case Study of University of Hail

This study assesses the current maintenance practices and analyze and rank the key factors affecting building facility maintenance at the Engineering College of the University of Hail. Maintenance plays a vital role in ensuring that educational facilities remain functional, safe, and conducive to learning. This study employs a mixed-methods approach, combining quantitative data from questionnaires and qualitative insights from interview question with building users and maintenance personnel. The results show varying levels of effectiveness across different building components, with flooring and walls receiving the highest ratings, while HVAC systems and elevators scored the lowest. Key factors affecting maintenance performance include delayed response times, lack of regular inspections, unskilled personnel, and insufficient funding. The study applies the Weighted Mean Score (WMS) and Relative Importance Index (RII) to analyze and rank these factors. Findings highlight the need for strategic, preventive maintenance planning. This research contributes to the broader understanding of facility management in higher education and offers actionable recommendations to improve maintenance practices, enhance user satisfaction, and extend the building's service life.

تقييم ممارسات الصيانة لمرافق المباني التعليمية: دراسة حالة في جامعة حائل

تُقيّم هذه الدراسة ممارسات الصيانة الحالية وتُحلّل وتُصنّف العوامل الرئيسية التي تؤثر على صيانة مرافق مبنى كلية الهندسة في جامعة حائل. تلعب الصيانة دورًا حيويًا في ضمان بقاء المرافق التعليمية وظيفية وآمنة وملائمة للتعلم. تعتمد هذه الدراسة على منهجية مختلطة، تجمع بين البيانات الكمية المستخلصة من الاستبيانات والرؤى النوعية المستقاة من اسئلة مقابلات مع مستخدمي المبنى والعاملين في الصيانة. أظهرت النتائج تباينًا في فعالية الصيانة بين مكونات المبنى المختلفة، حيث حصلت الأرضيات والجدران على أعلى التقييمات، بينما سجلت أنظمة التكييف والمصاعد أدنى التقييمات. تشمل العوامل الرئيسية التي تؤثر على أداء الصيانة: تأخر الاستجابة للطلبات، غياب الفحص الدوري، نقص الكوادر الماهرة، وقلة التمويل. استخدمت الدراسة كلًا من "متوسط الوزن المرجح "(WMS) و"مؤشر الأهمية النسبية "(RII) لتحليل هذه العوامل وتصنيفها. وتُبرز النتائج الحاجة إلى تخطيط استراتيجي وقائي لأعمال الصيانة. تُسهم هذه الدراسة في تعزيز الفهم العام لإدارة المرافق في التعليم العالي وتقدم توصيات قابلة للتنفيذ لتحسين ممارسات الصيانة، وتعزيز رضا المستخدمين، وإطالة عمر المبنى التشغيلي.

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Khaled, Alrashidi
May, 2025

Dedicated to Mother, Father, Brothers, and Sisters.

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List of Abbreviations

FM	Facility Management
BMS	Building Management System
KPI	Key Performance Indicator
BIM	Building Information Management
HVAC	Heating and Ventilation Air Conditioning
WMS	Weighted Mean Score
RII	Relative Importance Index
MPI	Maintenance Performance Index
BSI	British Standard Institute's
CIOB	Chartered Institute of Building

Chapter 1: Introduction

1.1 Overview and Background

Building maintenance is an essential aspect of maintenance management, ensuring that facilities remain functional, safe, and aesthetically appealing throughout building a lifecycle. Building maintenance has become a significant part of the work for the building in order to keep the buildings usable for the occupant (Ahmed, 2006). Maintenance practices, when effectively and timely implemented, can prolong a building's lifespan, reduce operating costs, and enhance occupant satisfaction. Maintenance activities are being carried out continuously to ensure that a building can function effectively at all times. Maintenance of a building is a routine activity that should be carried out because a building should serve as inheritable value and should be left for future generations. Therefore, maintenance work plays an important role in maintaining and sustaining the quality of the building and safety of occupants. However, when buildings are neglected, defects can occur which may result in extensive and unavoidable damage to the building fabric or structure (Ab Wahab & Basari, 2013).

Universities play a pivotal role in fostering education, research, and innovation. For such institutions, maintaining a conducive is critical to support teaching and learning activities. Like many education building facilities, faces challenges in its maintenance practices. Factors such as unimplemented schedule inspection, unskilled maintenance personnel, and delay of time response hinder the building's performance.

Despite the importance of building maintenance, research on the maintenance practices in education building facilities, particularly at University of Hail in Saudi Arabia, remains limited. This study seeks to bridge this gap by assessing the maintenance practices in elements at a building in the University of Hail and to analyze and rank the significant factors affecting the maintenance practices. By addressing these factors will provide ideas of the impact affecting maintenance practices and enhance the building's functionality.

This research contributes to the broader discourse on building maintenance by emphasizing the significance of maintenance in education building facilities. It highlights the need for proactive maintenance management to ensure safety, efficiency, and long-term viability.

1.2 Problem Statement

Maintenance is crucial for buildings to maintain physical characteristics and ensure normal performance over facility lifecycle (Chen & Tang, 2019). In educational facilities,

effective maintenance ensures that education environments remain safe, conducive to learning, and aligned with institutional objectives. Despite its importance, there is limited research focused on facility maintenance within higher education buildings in University of Hail in Saudi Arabia which plays a vital role in supporting teaching, research, and student learning. Limited empirical data exists regarding the specific conditions of building elements, the maintenance challenges faced by maintenance personnel, or the perceptions of users regarding service quality. However, challenges like unimplemented schedule inspection, and delay in time response might contribute to health and safety of the occupants and the deterioration of the building's condition. This research aims to address these concerns by conducting a focused assessment of the Engineering College building at the University of Hail. The study will assess the current maintenance practices of the building's elements. Furthermore, it will analyze and rank the factors affecting maintenance practices based on their significance. Addressing these critical issues is expected to enhance the overall functionality, performance, and sustainability of the building.

1.3 Research Questions

Given the above context, this research seeks answers to the following research question:

1. How effective are the current maintenance practices?

   This question seeks to assess the general condition of the building elements by the perceived performance of maintenance activities.

2. What are the factors affecting maintenance practices?

   This question explores the factors that influence the quality and consistency of building maintenance

3. What is the rank of factors affecting maintenance practices?

In order to assist with prioritization, this question aims to rank the factors based on effect.

1.4 Research Objectives

The general objective of this research is to assess the current practice of maintenance at a building element in University of Hail, specifically:

- To assess the current maintenance practices in building elements.
- To analyze the significant factors affecting the maintenance practices.
- To rank the factors affecting maintenance practices.

Table 1-1 Alignment of Research Questions with Corresponding Objectives.

#	Research Question	Research Objective
1	How effective are the current maintenance practices?	To assess the current maintenance practices in building elements.
2	What are the factors affecting maintenance practices?	To analyze the significant factors affecting the maintenance practices.
3	What is the rank of factors affecting maintenance practices?	To rank the factors affecting maintenance practices.

Chapter 2: Literature Review

2.1 Introduction

This chapter of the research presents a literature review to contextualize the study in res pect to existing publications on the topic. It does not aim to summarize the existing literature; instead, it seeks to illustrate the increasing interest in the subject area by trawl the current literature on maintenance procedures for educational building facilities. This chapter aims to demonstrate the significance of maintaining educational buildings, based on prior research regarding education building maintenance. Initially, a thorough overview of educational facilities is presented. Subsequently, the preceding research on education building and maintenance is presented. The topic of maintenance is thereafter introduced through available definitions, reasons, purposes, and types. The discussion focuses on the rationales for the maintenance of education buildings, and maintenance practices and challenges of education buildings maintenance are highlighted.

2.2 The Education building: an overview

This chapter begins with an overview of the elements that define an educational building. This is succeeded by a brief overview of its initial development.

2.2.1 Components of an education building

A straightforward definition of an education building is the physical structure that encompasses various sub-systems and components designed to accommodate and support the educational program (Muzir, 2017), and education building condition is defined as the physical state of education building to guarantee safe and continuous operation

(Bracknell Forest Council, 2012). To gain a clearer understanding, it is essential to review what these elements represent.

Figure 2-1: Education building components. source: *(Education Funding Agency, 2013).*

Like other structures, an educational building is composed of components which is the building systems (Muzir, 2017) as shown in Figure 2-1. First, the education architectural systems include walls, ceiling, doors, and windows, which together create an enclosed space for teaching and learning while also separating the interior and its occupants from the external environment in addition to the furnitures (Muzir, 2017). Second, the education building mechanical, electrical, structural systems consist of the elevators, electrical, HVAC (heating, ventilation, and air conditioning), foundation, columns, slabs, and plumbing (Muzir, 2017). Finally, an education building consists of various distinct yet interconnected components and systems, with its overall performance depending on several factors: the interaction between these components and systems, including the Building Management System (BMS); its interaction with users; and the effectiveness of maintenance practices (National Research Council, 2007).

2.2.2 Education building maintenance as research topic

Building maintenance is often described as a ‘not attractive’ and ‘unproductive’ activity (Jones & Collis, 1996; Muzir, 2017; Seeley, 1987), as it typically involves routine, time-consuming tasks that may not yield immediate visible benefits. Despite its critical role in ensuring the functionality, safety, and longevity of a building (C. P. Au-Yong et al., 2019). The construction of new buildings generally attracts more attention and enthusiasm than discussions about maintaining and repairing older, existing structures (Rubman, 2000).

2.2.3 An overview of College of Engineering Building at University of Hail

The College of Engineering building at the University of Hail was officially launched in 2017 as part of the university’s ongoing commitment to support engineering education

and innovation in the region. This purpose-built academic facility houses six main engineering majors, including Architectural Engineering, Civil Engineering, Electrical Engineering, Mechanical Engineering, Industrial Engineering, and Chemical Engineering. In addition, the college includes a Interior Design and Decoration program designated for female students, supporting inclusivity and academic diversity (University of Hail, 2025).

The building serves as an academic and research and is equipped to accommodate a total capacity of 2,219 students. The facility spans a total built-up area of 68,350 square meters, with additional outdoor spaces measuring 77,520 square meters (University of Hail TV, 2018). This generous footprint supports both academic functions and community-oriented activities, providing ample space for learning, collaboration, and recreation.

Figure 2-2 College of Engineeing at University of Hail *(University of Hail, 2025)*

In terms of instructional infrastructure, the College of Engineering includes 69 lecture halls (University of Hail TV, 2018), designed to host classes of various sizes with modern instructional technologies. The facility also contains 8 laboratories that support practical, research-based learning across the various engineering disciplines, in addition to 48 workshop spaces, of which 3 are classified as large-scale workshops (University of Hail TV, 2018). Which suitable for advanced engineering projects and prototype development.

A key feature of the building is its auditorium, which is equipped with an advanced sound system and lighting technology, designed to accommodate 150 attendees (University of

Hail TV, 2018). The auditorium supports events such as academic presentations, seminars, and conferences. Accessibility and vertical transportation are facilitated through the inclusion of ten elevators, ensuring mobility for all users across the multi-story facility.

Furthermore, the building is equipped with key support facilities that enhance the academic environment. These include a library offering engineering references and study areas, and a mosque to accommodate the religious needs of students and staff, providing spaces for daily prayers and gatherings.

Overall, the College of Engineering building at the University of Hail represents a well-integrated academic environment, purposefully designed to meet the educational, practical, and cultural needs of engineering students and faculty. Its layout, facilities, and capacity reflect the university's vision of providing high-quality engineering education aligned with the goals of quality of life and innovation.

Table 2-1 Summary of information of College of Engineering Building.

#	Info.	Count	Unit
1	Year of Launch	2017	Year
2	Total Student Capacity	2,219	Students
3	Built-up Area	68,350	Square Meters
4	Outdoor Area	77,520	Square Meters
5	Lecture Halls	69	Space
6	Laboratories	8	Space
7	Workshop Spaces	45	Space
8	Large-Scale Workshops	3	Space
9	Auditorium Seating Capacity	150	Seats
10	Elevators	10	Units
11	Library	1	Space
12	Mosque	1	Space

2.3 Buildings Maintenance

Building maintenance is regarded as an activity within the broader framework of facilities management (Atkin & Brooks, 2009). It is also regarded as a part of the construction

sector indeed, building maintenance has consistently been regarded as the 'poor relation' of the construction business, receiving only implicit acknowledgment of its importance, both within the industry and among property owners (Chanter & Swallow, 2007). Perhaps this stems from perception that maintenance is regarded as a non-core job that offers supports services within organizations (Waheed & Fernie, 2009).

2.3.1 Definition of Building Maintenance

The general maintenance literature provides various definitions of maintenance as follows. The British Standard Institute's (BSI) definition of maintenance seems to be increasingly broadening throughout the years. Maintenance is described as the work performed to restore all facilities, encompassing every aspect of a site or building, to an acceptable quality (British Standards Institution, 1964). It was subsequently described as the integration of all technical and administrative efforts, including supervisory measures, aimed at maintaining an item in, or restoring it to, a condition in which it can execute a requisite function (British Standards Institution, 1991). Maintenance was further refined and described as the endeavour associated with various technical and administrative measures to maintain a physical asset in, or restore it to, a condition capable of performing a specified function (British Standards Institution, 1993).

The Chartered Institute of Building (CIOB) defined building maintenance as the activities performed to preserve, restore, or enhance all facilities, including every component of a building, its services, and its surroundings, to a specified standard, established by the equilibrium between necessity and available resources (Chartered Institute of Building, 1990). It is described as work performed to maintain, restore, or enhance every facility, its services and surroundings, to meet suitable requirements, and to maintain the value and utility of the facility' (Seeley, 1987). The shortest definition is to maintain it in as close to its original condition as feasible' (Stewart, 2007). From the perspective of educational planners, maintenance is characterized as an ongoing activity aimed at ensuring the efficiency of the educational function and environment of education buildings. According to (Dzulkifli et al., 2021) Maintenance is a systematic process to preserve features and resources, functioning at optimal levels to meet building standards and performance criteria.

In summary, the core meaning of maintenance definitions suggests two key processes: retaining and restoring. Retaining involves work performed to prevent failure, while restoring refers to actions taken after a failure has occurred. In the area of education

building maintenance, this covers activities aimed at preserving the school structures and the associated components to ensure remain in optimal shape.

2.3.2 Reasons For Buildings Maintenance

Buildings do not stay unchanged throughout the lifespan (Abdul Lateef et al., 2011; Douglas, 1996; Wood, 2009) as undergo changes, evolve, and adapt. Begin to age from the moment are completed (Arditi & Nawakorawit, 1999) and will progressively decay and deteriorate over time (Brand, 1995; Douglas, 1996; Hawkins & Lilley, 1998; Levitt, 2013) caused by to several factors as outlined as follows: the fluctuations of climate (Chan, 2000; Douglas, 1996; Hawkins & Lilley, 1998; Wood, 2009); natural deterioration (Chan, 2000; Douglas, 1996; Hawkins & Lilley, 1998); use (Douglas, 1996; Levitt, 2013); misuse; and expected operational lifespan (Cruzan, 2009; Stanford, 2010). Ultimately, all these factors would undermine the building's ability to accommodate the purpose for which it was designed (Levitt, 2013). Such deterioration hopefully could be reduced to a certain degree by effective operational and maintenance procedures (Ashworth, 1999; Chandra & Sudhakar, 2020; Hawkins & Lilley, 1998).

The maintenance activity is crucial for both the existing and newly constructed buildings (Dzulkifli et al., 2021). Maintenance is necessary for the whole duration that the buildings are utilized or occupied, ensuring that the various facilities align with the main maintenance strategy (West et al., 2024). An innovative method for building maintenance, centered on assessing failure repercussions and formulating appropriate strategies for each component, can decrease expenses and enhance building performance while maintaining occupants' satisfaction (O'Brien et al., 2017). To maintain the building in its current condition or to restore it to its former condition (Wood, 2009). and to ensure the optimum functionality during its life cycle (Pal et al., 2017).

To clarify this cycle of an education building's lifespan, according to (Muzir, 2017) on the five life phases of education buildings though several decades as shown in Figure 2.

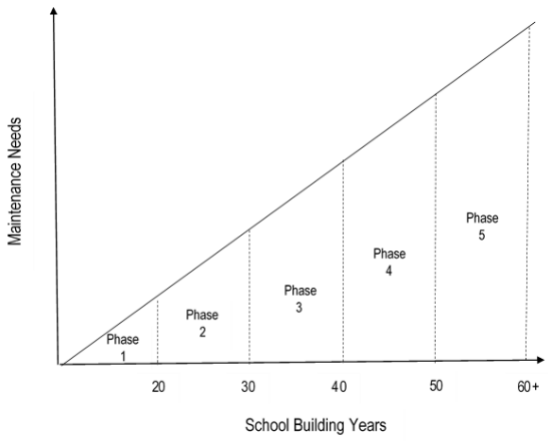

Figure 2-3: Maintenance needs vs education building years *(Muzir, 2017)**.***

In Phase 1, including the initial 20 years of the educational building's lifespan, maintenance is limited to basic repairs and minor enhancements to meet alterations in the teaching program. In phase 2 which next decade the educational building will require an increasing amount of annual maintenance and additional replacement of deteriorated equipment. In phase 3 involves a significant increase in general maintenance, as the majority of the original equipment will have been replaced, necessitating the substitution of key components such as electrical systems and roofing fittings due to the building's natural deterioration. When the educational building is between forty and fifty years old or in Phase 4, it is experiencing accelerated degradation. In the last phase, or Phase 5, the educational building will either be entirely reconstructed or demolished. Essentially, it shows that as the education building age increases, an increased level of maintenance becomes necessary (Stewart, 2007). This occurs because building materials deteriorate over time, leading to a reduction in the structural integrity and systems (Drochytka & Petránek, 2007). It is crucial to recognize that age is not the factor that affects the old education building; rather, it is the absence of care and maintenance (Rubman, 2000). According to (Ismail et al., 2016) abandoned reinforced concrete structures suffer a severe deterioration in structural integrity and durability due to environmental influences, probably failing to meet acceptable strength standards within 12 years. Even newly constructed educational buildings that do not receive the necessary maintenance will deteriorate rapidly (Rubman, 2000).

2.3.3 Purpose of Buildings Maintenance

As previously mentioned, each educational facility comprised numerous different components (Brand, 1995; Duffy, 1990; Lstiburek & Carmody, 1996; Muzir, 2017) and each component has a predetermined expected service life, which to some degree

determines the necessity for building maintenance (Janjua et al., 2019; Thorne et al., 2013). Therefore, as illustrated in Figure 3 below the primary objective of maintenance is to avoid or mitigate the deterioration or decline in the service quality provided by each building component over its intended service life (Stanford, 2010). But Maintenance does not encompass the upgrading process that may be necessary to meet additional performance expectations beyond what the component was initially designed to deliver (Stanford, 2010).

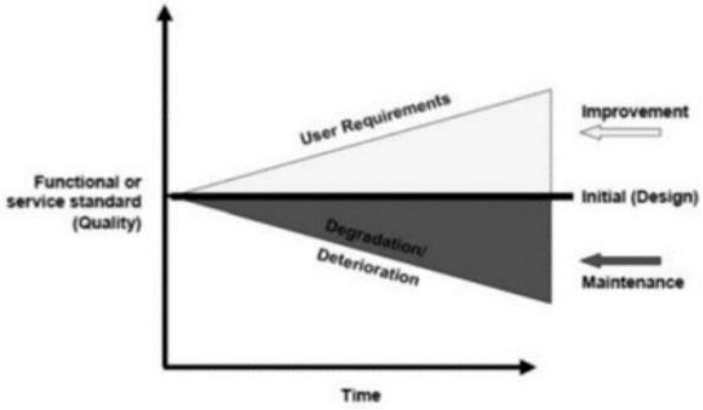

Figure 2-4: Functional or service standard VS Time *(Stanford, 2010).*

The objective of maintenance within an educational building context is ensuring that the facility, as a crucial asset, can support the institution's core operations efficiently and effectively, thereby providing a safe, suitable, and quality learning environment for its occupants' (Aquino, 1985; Olanrewaju & Abdul-Aziz, 2015; Szuba & Young, 2003).

In summary there are plenty of compelling reasons to conduct maintenance work.

a. Maintenance involves maintaining the building in good condition, extending its lifespan, mitigating deterioration, ensuring a safe environment, and upholding the building's aesthetic appeal.
b. From an economic perspective, maintenance could reduce the necessity for substantial repair actions. In certain cases, repair work can be more expensive than maintenance work financially. Therefore, it is preferable to conduct maintenance work rather than extend the duration of repair activities.
c. Proper routine management and maintenance will reduce the necessity for extensive repairs and is the most cost-effective method of preserving an asset.
d. Maintenance might also create employment opportunities. Certain maintenance tasks necessitate the expertise of repair specialists or maintenance professionals to do the essential work.
e. Maintenance will also ensure the safety of the building and occupants.

2.4 Maintenance Strategies of Building

Effective maintenance strategies are essential for ensuring the longevity, functionality, and performance of buildings. A well-structured maintenance approach helps preserve a building's value, minimize operational disruptions, and enhance occupant safety and comfort. Maintenance strategies encompass various methodologies tailored to address different aspects of building upkeep, including preventive, corrective, and condition-based maintenance. These strategies aim to prevent premature deterioration, optimize resource allocation, and ensure compliance with regulatory and performance standards. The following sections outline key maintenance strategies, classifications, and the policies that govern implementation (West et al., 2024).

2.4.1 Building Strategy

A building strategy should define the necessary service and performance standards for each facility. It should also include measures to maintain and protect the property's value when applicable. Regular reviews should be conducted at specified intervals or when there are significant changes in service or performance needs to ensure the strategy remains relevant and effective (West et al., 2024).

2.4.2 Maintenance Strategies Types

The maintenance strategy of a building includes many sub-strategies for its components. Maintenance involves a combination of planned/preventive and reactive tasks essential for maintaining the system in a condition that allows it to function satisfactorily. There are two main types of maintenance: preventive (periodical), corrective maintenance (British Standard Institution, 2010).

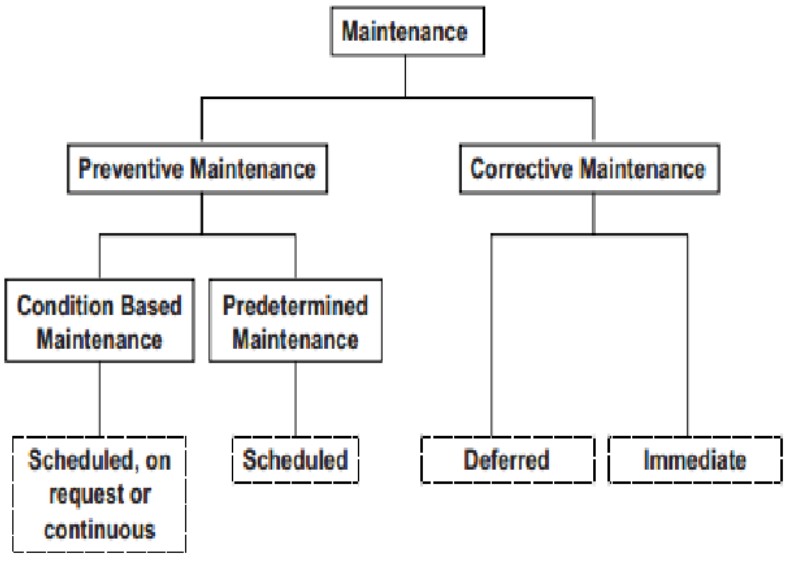

Figure 2-5: Maintenance strategies *(British Standard Institution, 2010).*

2.4.2.1 Preventive Maintenance

it is a series of inspections and services conducted periodically according to a predetermined schedule established by manufacturers and maintenance specialists to the physical building and systems equipment to address deficiencies, if present, prior to the onset of a malfunction or operational failure and minimizing corrective maintenance costs (Kyle et al., 2000; Schreiber, 2020).

2.4.2.1.1 Predetermined Maintenance

There will be plans developed for the building's sub-systems and components. The plan will provide a comprehensive delineation of activities and resources (personnel, materials, machinery) for budget formulation and the identification of downtime times (intervals during which the service would be inaccessible to the user or system).

2.4.2.1.1.1 Scheduled Maintenance

This is a type of preventive maintenance conducted at specified intervals of time, operational cycles, and miles (Cobbinah, 2010). Planned building maintenance is regarded as the most simple and economical method for protecting a building. This is a post-construction activity essential for maintaining the building's reliability, preventing premature deterioration and significant damage, hence ensuring its functionality. It includes tasks that must be performed daily, weekly, and regularly. This constitutes a form of preventive maintenance conducted at specified intervals of time, operational counts.

2.4.2.1.2 Condition-based maintenance

This type involves conducting maintenance when the condition of building elements has changed or deteriorated, with the ideal timing for maintenance established by monitoring the system's real state, performance, or other condition parameters. This idea acknowledges that the primary rationale for conducting maintenance is the change in its condition or performance of an item; such maintenance tasks are strategically planned through effective monitoring of the building's components, services, and equipment prior to the occurrence of significant failures. Components with extended lifespans or those considered critical due to functionality or technology must be periodically inspected according to a predetermined inspection plan; subsequent actions will be dictated by the condition of the item as revealed by the inspection process.

Predictive maintenance and condition-based maintenance differ in measurement methods and timing of implementation. Condition-based maintenance utilizes real-time

performance data to identify issues post-initiation of failure. Conversely, predetermined maintenance considers all relevant information (historical, current, and prospective) and identifies an optimal time for maintenance prior to any failure.

2.4.2.2 Corrective Maintenance

it is an operation conducted to restore parts or components according to a set schedule, involving the replacement of damaged or obsolete components and the repair of certain parts for reuse, aim to ensure the ongoing functionality of the building's equipment and facilities (Kyle et al., 2000).

2.4.2.2.1 Deferred Corrective Maintenance

Delayed corrective maintenance executed subsequent to problem detection, in accordance with established protocols

2.4.2.2.1.1 Emergency/Immediate Maintenance

Refers to the series of actions undertaken to restore components or parts following unexpected damage or failure, which makes inoperable, often due to inadequate corrective maintenance practices (Kyle et al., 2000). However, some research indicates a prevalent lack in preventive and corrective maintenance and maintenance feedback during design phase in current educational facilities worldwide, like in Saudi Arabia (Hassanain et al., 2014), United State of America (Council of the Great City Schools, 2014), Australia (Victorian Auditor-General Office, 2008), and El Salvador (Abend et al., 2006).

2.4.3 Maintenance Policy

A well-structured maintenance policy is essential for ensuring effective building performance. The key elements of such a policy include:

- Align with objectives and laws: Support the building strategy and comply with legal requirements.
- Set service levels: Define clear standards for inspection and maintenance activities.
- Define goals and priorities: Establish specific maintenance goals, strategies, and priority actions.
- Use diagnostic tools: Incorporate tools to support maintenance planning and decision-making.
- Optimize costs: Manage maintenance expenses efficiently within the allocated budget.

- Address obsolescence: Consider aging components that may impact building performance.
- Set measurable targets: Include both qualitative and quantitative objectives.
- Ensure quality and service: Specify expected quality standards and service levels.

2.5 Maintenance of Education Buildings

The quality of educational facilities directly influences teaching and learning, and effective maintenance can ensure the offering of better facilities (Daniel et al., 2023). Therefore, the primary objectives of a building maintenance strategy are to foster a physical environment that enhances the teaching-learning process and to protect the facilities assets. There are types of building maintenance is classified into preventive and corrective types. Preventive maintenance is performed regularly to avoid failures and includes scheduled, predetermined, and condition-based maintenance, which relies on the actual condition of building components. Corrective maintenance occurs after a fault, including deferred repairs done later and emergency maintenance for urgent failures. These strategies ensure building safety, functionality, and efficiency.

The responsibility of constructing and managing educational facilities has increasingly become a crucial aspect of effective practice for both district and educational administrators (Haniyah et al., 2023). Moreover, this is exacerbated as maintenance is considered one of the foremost significant difficulties concerning educational facilities (Alsayyari et al., 2019).

Regular maintenance is essential for maintaining colleges in optimal condition; failure to perform maintenance may lead to facility issues, potentially resulting in health and safety concerns and escalating repair expenses (Lufkin et al., 2012).

2.6 Indicators In Measuring Building Maintenance

The current condition of building components can be evaluated using various factors. The frequently assessed variables include particular building components, such roofs, walls, and foundations that deteriorate due to insufficient maintenance, the age of the buildings, and the overall design of the buildings (Cobbinah, 2010). In addition, (Cobbinah, 2010) created a set of indicators for assessing the maintenance conditions of public buildings, as shown in table 2.1 below.

Table 2-2 Indicators of Building Maintenance

Building elements	Indictor of measuring building maintenance
Roofs	Leakage, rusty, partly ripped off, completely ripped off
Windows and Doors	Partly broken down, completely broken down, no problem
Painting	No paint, faded paint, dirty paint, well painted
Floor	Developed cracks, peeled off, partly broken down, no problem
Walls	Partly broken down, developed cracks, peeled – off, tilted Exposed, hanging, weak
Foundation	Exposed, hanging, weak
Age of the building	Old (above 50 years) medium-aged (20-50 years) and younger buildings (less than 20 years)
Housing type	Detached, semi-detached, single store, multi-store and terrace
Building facilities (toilet, water, bathroom, electricity)	Good, fairly good and bad

Source: *(Cobbinah, 2010)*

2.7 Factors Affecting Maintenance Practices

Effective building maintenance is crucial for ensuring the longevity and functionality of facilities. However, several challenges hinder the efficiency of maintenance practices, leading to increased costs and reduced occupant satisfaction. This section examines key factors that contribute to maintenance challenges, including the absence of regular inspection and planned maintenance, delayed responses to maintenance requests, and inadequate quality assessment measures. Additionally, issues such as unskilled maintenance personnel, faulty design and construction errors, misuse of facilities, high occupant density, and building aging are explored. Understanding these factors is essential for developing strategies to enhance maintenance practices and improve overall building performance.

2.7.1 No adoption of regular inspection and planned maintenance

The absence of scheduled maintenance procedures contributes to the deteriorating of facilities (Chua et al., 2018; Hauashdh et al., 2021; Rodrigues et al., 2018).

2.7.2 Delay of time response to maintenance requests.

Delays or lack of response to maintenance requests arise from maintenance managers facing budgetary limitations and personnel shortages. Determining the priority for addressing maintenance requests enhances the satisfaction of building occupants. Users who spend extended periods in buildings, such as university, exhibit adverse reactions to delays or deficiencies in responding to maintenance requests (Cao et al., 2015). (Ogunbayo et al., 2022) suggested that user satisfaction is a key indicator of effective maintenance performance.

Non-application of user satisfaction according to (Yong & Sulieman, 2015) the absence of user satisfaction surveys affects the effective management of building maintenance. The authors suggest a potential correlation between maintenance management practices and occupant satisfaction, as the maintenance department's delivery of high-quality services enhances building performance, subsequently raising user satisfaction with the building's condition. In addition, Inadequate verification and assessment of contractor performance by maintenance management are expected to lead to inferior quality of maintenance work (Myeda & Pitt, 2014).

2.7.3 Unskilled Maintenance Personnel.

Building maintenance necessitates the engagement of skilled personnel. Therefore, it is essential to employ technicians with the requisite abilities. This approach can result in enhanced quality of work, decreased expenses, and a reduction in the time necessary for maintenance activities (Ofori et al., 2015). In this study, the issue of unskilled maintenance personnel was highlighted by both key stakeholder groups—building occupants and maintenance personnel—as a significant factor affecting maintenance effectiveness.

2.7.4 Faulty Design and construction errors.

The deterioration of building structures can be significantly accelerated by design deficiencies. Therefore, it is imperative to integrate maintenance considerations during the design phase to mitigate potential maintenance challenges (Khalid et al., 2019). In-addition the cause for increased repairs in construction projects is construction errors, involving the installation of poor materials and the application of ineffective construction

techniques, these errors require rework and continuous maintenance during the project's duration (Hassanain et al., 2019).

2.7.5 Misuse of building facilities.

Building occupants frequently contribute to the degradation of buildings, which usually appears in multiple ways. The act of vandalism involves intentional damage or defacement of a building. Inappropriate use of the facility will lead to its deterioration and necessitate increased maintenance, resulting in significant expenses (Ofori et al., 2015).

2.7.6 Occupant Density.

(Kajavathani & Ramachandra, 2022) shows that the number of occupants in the building is significantly influenced by the maintenance expenses.

2.7.7 Building age.

A correlation exists between the building's age and its maintenance expenses. The expense of maintenance increases with the building's age due to various activities, including repainting, tile replacement, and other essential tasks required to preserve the building's aesthetics. Moreover, the plumbing and drainage systems of antiquated structures necessitate more frequent maintenance and repairs due to issues like corrosion. The cumulative maintenance expenses of a building are expected to rise with age (Ali et al., 2010).

2.7.8 Unavailability of Skilled Appointed Maintenance Personnel

The efficacy of the building can be assessed by its maintenance expenses. Maintenance performance is determined by the disparity between estimated and real costs; thus, it can be inferred that optimal maintenance performance is achieved when actual costs are lower than estimated costs. A significant factor contributing to elevated maintenance costs during implementation is the deficiency of maintenance personnel possessing adequate expertise in maintenance tasks. Insufficient knowledge results in resource wastage and equipment misapplication, culminating in adverse outcomes such as the inability to recognize and rectify problems or a deficiency of oversight during maintenance activities (P. Au-Yong et al., 2014).

2.7.9 Inaccurate As-Built Drawings

Construction contractors may fail to deliver accurate as-built drawings to facility owners, which maintenance contractors subsequently utilize. Maintenance contractors may form inaccurate assumptions when conditions vary from those illustrated in the as-built

drawings. As a result, excessive time is expended on the job site, hence escalating maintenance expenses (Hassanain et al., 2014).

2.7.10 Lack of Funding

The insufficiency of financing is an essential factor affecting the efficacy of maintenance practices. The availability of funds directly affects the extent of maintenance work and, in certain cases, dictates the quality of materials employed for building maintenance (Ebekozien, 2021).

2.7.11 Lack of Adoption of Building Information Modeling (BIM)

BIM serves as a valuable information source for managing maintenance activities in both existing and newly constructed buildings, aiding in planning and decision-making processes (Hauashdh et al., 2021). Utilizing BIM during the design phase enables the assessment of the maintainability of building components (Liu & Issa, 2013). Additionally, employing BIM in the operation phase facilitates maintenance planning, maximizing its benefits. These benefits include analyzing breakdown patterns based on topological relationships and visualizing spatial connections of work orders to enhance interactive and preventive maintenance.

2.8 Conclusion

This literature review has examined the critical aspects of educational building maintenance, emphasizing its importance in preserving facility functionality and supporting educational objectives. Educational buildings require systematic maintenance approaches to prevent deterioration and extend service life. Despite its importance, building maintenance often receives less attention than new construction, despite its critical role in facility performance.

Multiple factors affect maintenance effectiveness, including inspection regularity, response time, personnel skills, design quality, user behaviour, building age, and funding availability. As educational buildings continue to age and face increasing demands, adopting comprehensive maintenance strategies becomes crucial for protecting physical assets while creating optimal environments for teaching and learning.

Chapter 3: Methodology

3.1 Introduction

Research methodology includes the principles that guide this research in doing research activities. It provides the fundamentals for planning, strategizing, designing, and executing effective research (Archer, 2023).

This chapter outlines the methodological approach employed to assess the maintenance practices and factors affecting maintenance effectiveness at the Engineering College building of the University of Ha'il. Educational building maintenance requires a comprehensive understanding of multiple interrelated factors, including inspection procedures, response timeliness, personnel expertise, design quality, user behaviour, building age, and funding availability. To effectively capture these diverse elements, this study adopts a mixed-methods research design that integrates both quantitative and qualitative approaches. The methodology is specifically designed to assess current maintenance practices, analyze significant factors affecting maintenance practices, and rank the factors according to the relative importance. Through a carefully structured research design, appropriate sampling techniques, and rigorous data analysis methods, this study aims to provide meaningful insights that can contribute to improving maintenance practices for educational facilities.

3.1.1 Research Objectives

The research objectives are established to guide the investigation and ensure that the study's goals are achieved effectively. The primary objectives of this research are as follows:

1. To assess the current maintenance practices at the elements of the engineering college building at University of Hail.
2. To analyze the significant factors affecting the maintenance practices.
3. To rank the factors affecting the maintenance practices.

These objectives will guide the research process and data collection, enabling a comprehensive assessment of maintenance practices for educational building facilities at the University of Hail. The research objectives of this study are meticulously crafted to direct the investigation towards a comprehensive understanding of maintenance practices for educational building facilities, with a specific focus on the engineering college building at the University of Hail.

The first objective focuses on assessing the current maintenance practices implemented in building elements at the engineering building through a detailed evaluation of specific

building elements. This involves examining the physical condition and maintenance status of critical components including walls, floors, ceilings, HVAC systems, windows, doors, roofs, electrical systems, plumbing fixtures, and other essential infrastructure. By systematically assessing these elements, the study will establish a clear picture of how effectively maintenance is being planned, scheduled, and executed for each component, including both preventive and corrective maintenance strategies. This element-by-element assessment will provide concrete evidence of maintenance effectiveness and identify specific areas requiring attention.

The second objective of the study to analyze the significant factors affecting maintenance practices. This includes investigating factors that influence maintenance practices and effectiveness, such as response time to maintenance requests, skill level of maintenance personnel, user behaviour, occupant density. The study aims to understand how these factors affect the quality and efficiency of maintenance practices and activities at the engineering college building.

The third objective focuses on ranking the factors affecting maintenance practices based on the relative importance. This objective seeks to prioritize the identified factors according to the level of influence on maintenance practices. The study will provide valuable insights for maintenance managers and decision-makers at the University of Hail, enabling to address the most critical factors first.

Collectively, these objectives will provide a comprehensive assessment of maintenance practices at the engineering college building, identify key factors affecting it for opportunities for improvement, and prioritize factors requiring attention. The findings will contribute to enhancing the effectiveness of maintenance practices at the University of Hail, ultimately improving the quality of the educational environment and extending the lifespan of the facilities.

3.1.2 Scope and Limitation

This research focuses on assessing the maintenance practices for the Engineering College building at the University of Hail, Saudi Arabia. The study assesses the condition of various building elements. The scope encompasses the perspectives of two key stakeholder groups: building occupants (faculty, staff, students, and visitors) and maintenance personnel. The research aims to identify and rank factors affecting maintenance practices within this educational facility.

Sample Size and Representativeness of the building: the study is confined to a single educational building at the University of Hail, which may not fully represent the maintenance practices across all university buildings or other educational institutions in Saudi Arabia or elsewhere. As such, the findings may not be generalizable to all campus facilities or regions with different environmental, cultural, or administrative contexts.

Self-Reported Data: The research relies heavily on questionnaires and interviews with building occupants and maintenance personnel, which may introduce subjective biases. Participants may provide responses influenced by personal perceptions, social desirability, or limited knowledge about the maintenance practices in place, potentially affecting the accuracy of the data collected.

Cross-sectional data: Data collection is limited to a specific time frame, which may not capture seasonal variations, cyclical maintenance patterns, or long-term trends in maintenance practices. Environmental factors that vary seasonally, such as temperature can significantly impact building conditions and maintenance requirements, but these variations may not be fully reflected in the findings.

Methodological Limitations: The questionnaire and interview approach may not fully capture the complexity of maintenance challenges. Some issues may be too intricate or localized to be identified through a standardized survey, limiting the depth of the data collected. Additionally, technical aspects of maintenance that require specialized assessment tools or expertise may not be adequately evaluated through the methods employed.

Participant Availability and Willingness: The study's findings depend on the availability and willingness of participants to provide accurate and comprehensive information. Factors such as busy schedules, reluctance to disclose certain information, or participant attrition may affect the quality and quantity of data collected.

Sample Size and Representativeness of the users: The study is confined to a single educational building at the University of Hail. The sample size may not be fully representative of the entire population of building users and maintenance staff, potentially limiting the generalizability of findings.

Despite these limitations, the research aims to provide valuable insights into the maintenance practices at the Engineering College building. The findings should be interpreted with these limitations in mind, and future research could address these

constraints through expanded scope, alternative methodologies, or longitudinal approaches.

3.2 Research Design

According to (Indu & Vidhukumar, 2020), a research design is a structured plan for the proposed study that integrates all key components of a research project, serving as a conceptual framework that guides the research process. Therefore, a research study requires a design or framework prior to the initiation of data collecting or analysis. A study design/framework is the methodology that directs researchers in the collection, analysis, and interpretation of data.

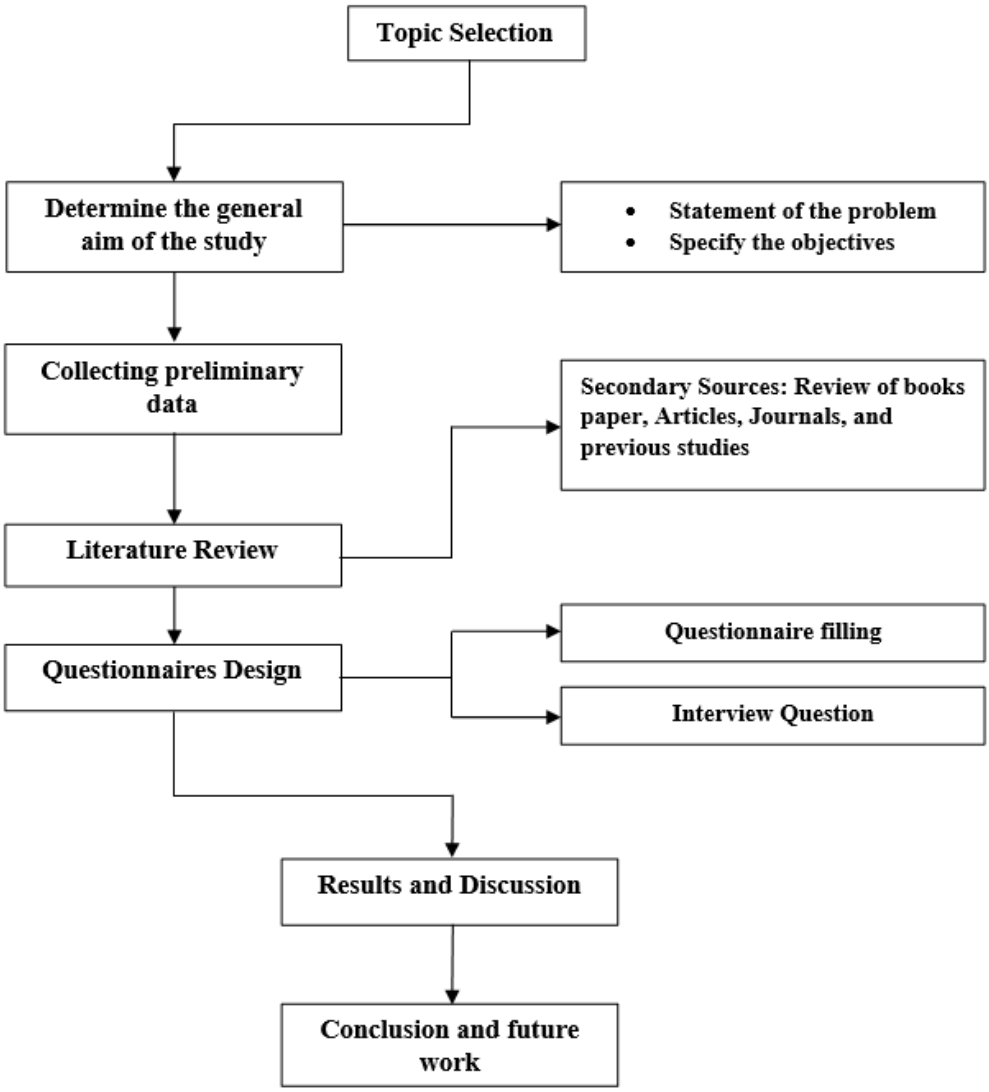

Figure 3-1: Research Design

This research adopts a descriptive, cross-sectional study designed to assess the perspective held by a group of occupants and maintenance personnel in engineering building at the University of Ha'il toward the maintenance practices of the element of the building at a single point of time.

3.2.1 Research Design Selection

This study adopts a mixed-method research design, integrating both quantitative and qualitative approaches to ensure a comprehensive evaluation of maintenance practices in educational building facilities. The combination of these methodologies enhances the depth and reliability of the findings by providing both statistical insights and descriptive context.

The quantitative approach involves the collection and analysis of numerical data from a structured questionnaire distributed to building occupants and maintenance personnel. This method allows for the systematic examination of trends, relationships, and patterns in maintenance practices, providing measurable insights that contribute to understanding the efficiency and challenges faced in facility management.

On the other hand, the qualitative approach is utilized to gather descriptive and contextual information through interviews and open-ended survey responses. This method enables a deeper exploration of the underlying factors affecting maintenance practices, capturing perspectives that may not be fully represented in numerical data.

3.2.2 Rationale for the Research Design

As highlighted by (Hanson et al., 2005), the term used to describe mixed methods research varies considerably in discussions about its procedures. However, a core aspect of these approaches is the concept of combining or integrating different methods. The term mixed methods are probably the most suitable (Hanson et al., 2005). As explained by (Pinto-Llorente et al., 2018), mixed methods refer to the integration of both quantitative and qualitative perspectives at specific points in research. Mixed methods research design fundamentally involves the integration of both qualitative and quantitative data gathering and analysis within a single study (Pinto-Llorente et al., 2018).

The rationale for using mixed methods in this study is based on the following points. Firstly, within the framework of this research, to assess educational building maintenance practices is a complex subject as it involves various stakeholders including maintenance personnel, administrative staff, faculty members,

students and visitors. Each of these groups has different perspectives, experiences, and priorities regarding facility maintenance, so a mixed methods study is selected to effectively understand this complexity in the subject matter (Guetterman & Fetters, 2018).

Secondly, the mixed methods approach is considered most appropriate for this research as it integrates the strengths of both quantitative and qualitative research because of the increasing appreciation of the limitations of single methods (Gillham, 2005). Moreover, there is a consensus that integrating multiple methods can reinforce the research (Turner et al., 2017). Since the unique aspects of qualitative data, such as interviews questions, can provide insights that cannot be obtained through standard quantitative surveys (Fakis et al., 2014). Fundamentally, the survey quantifies the issue, whereas the interviews provide detailed insights (Wellington, 2000).

The quantitative component of the research, through the questionnaire, allows this research to gather general information and highlight key points regarding educational building maintenance. On the other hand, the qualitative methods are better suited for gaining a deeper, more comprehensive understanding of the educational building maintenance issues, if any. These methods offer this research the chance to explore the finer details of the quantitative data, focusing on important aspects that were either not captured or not fully addressed by the questionnaire.

Thirdly, the use of mixed methods in this research enables an understanding of the world from the respondents' perspectives, thereby giving voice of the participants, which is crucial in qualitative research (Denzin & Lincoln, 2000). Therefore, it appears that a deeper comprehension view of the assessment of educational building maintenance, with regard to its current practices and implications for end users, will be achieved through a mixed methodologies approach.

3.2.1 Alignment with Research Objectives

The research objectives will be addressed using the designed methodology, as outlined below. Table 3-1 illustrates the clear relationship between the research objectives and the methodology.

Table 3-1 Research objectives and its designed methodology

Research Objectives	Designed Methodology
To assess the current maintenance practices in building elements at engineering college building at university of Hail.	Literature reviewing, questionnaires and interview questions
To analyze the significant factors affecting the maintenance practices.	Literature reviewing, questionnaires and interview questions
To rank the factors affecting the maintenance practices.	Literature reviewing, questionnaires

3.3 Sampling Strategy

3.3.1 Study Area

The University of Ha'il was established in 2005, an institution known for its commitment to academic excellence. The University has 14 colleges, namely, College of Sciences, Computer Science and Engineering, Medicine, Applied College, Business Administration, Nursing, Dentistry, Pharmacy, Applied Medical Sciences, Health Informatics, Sharia and Law, Literature and Art, Education, and College of Engineering. The study is conducted at the College of Engineering building of the University of Ha'il. It is located in Ha'il city, Saudi Arabia specifically in the northern-central region on Latitude of 27.662726°N and Longitude 41.720634°E. The College of Engineering building serves as a key educational facility within the university, housing various academic departments, administrative offices, classrooms, laboratories, and faculty offices.

3.3.1.1 Research Population

The population comprises key stakeholders involved in the maintenance practices of the Engineering College building at the University of Ha'il. This includes building occupants such as faculty members, administrative staff, visitor, students, and maintenance personnel responsible for ensuring the functionality and sustainability of the facility. The selection of this population is based on direct involvement with the facility's maintenance practices and firsthand experience with the challenges and effectiveness of current maintenance practices on the building elements.

3.3.2 Sampling Technique

To ensure the selection of respondents with relevant firsthand experience, a purposive sampling technique was employed. This method allows for the deliberate selection of individuals who possess specific knowledge and insights related to maintenance practices

of the building elements, ensuring the collection of meaningful and in-depth data. Participants, including building occupants and maintenance personnel, were chosen based on the direct involvement with the Engineering College building's elements.

3.4 Study Instrument

To develop a well-structured and objective-driven questionnaire, a comprehensive literature review was conducted, focusing on previous studies related to building maintenance practices. A pretested and validated questionnaire was designed and developed based on the literature review, ensuring its alignment with the research objectives. The questionnaire consists of Likert Scale questions, each offering five response options: (1 = Very Bad; 2 = Bad; 3 = Average; 4 = Good; 5 = Very Good.) and (1 = Very Low; 2 = Low; 3 = Average; 4 = High; 5 = Very High.).

The five Likert Scale questions were employed in this study due to clarity for participants and the minimal effort required for completion. Another rationale for employing five-point Likert Scale questions is the quick gathering of data from a large number of participants, and the interpretation validity can be established through different means

It was structured into multiple sections to gather participant background, assess the condition of various building elements, and factors influencing maintenance practices. Participants were asked to rate the condition of building elements such as walls, floors, roofs, doors, and windows, as well as services like HVAC systems, water supply, and electrical systems. Additionally, respondents provided insights into factors affecting maintenance efficiency, including regular inspection, response time, personnel expertise, and building design.

To enhance the validity and reliability of the findings, the questionnaire was supplemented with follow-up interview questions. These interviews provided qualitative insights that complemented the quantitative data collected through the survey.

The questionnaire was developed in both English and Arabic to ensure participants do not face any difficulty. After this, the questionnaire was finally distributed to the study participants. The participants were briefed about the study objectives and were assured confidentiality and anonymity.

3.5 Method of Data Collection

The data for this study was collected using an online survey tool, specifically SurveyHero Forms, to facilitate efficient distribution and accessibility for participants. The

questionnaire was designed to gather quantitative data from faculty members, students, administrative staff, visitors, and maintenance personnel of college of engineering at the University of Ha'il, assessing the perceptions of maintenance practices and the factors influencing. To enhance the depth of the study, an interview question was included at the end of the questionnaire. Participants were required to provide written responses to this question before submitting the form. This approach ensured the collection of both quantitative and qualitative data within a single survey, allowing for a comprehensive assessment of maintenance practices on building elements and challenges.

The questionnaire was distributed through social media platforms, and direct communication with potential participants. A brief introduction at the beginning of the survey outlined the objectives of the research and the significance of participants' contributions. To maintain confidentiality, no personal identifying information, such as names, email addresses, or phone numbers, was collected. Respondents were encouraged to complete the survey within approximately 2–3 minutes.

Table 3-2 Measurement item and question section

Measurement Item	**Question Section**
Part A General Information.	Age. Gender. Affiliation with the University.
Part B Assessing the current maintenance practices of engineering college building at University of Hail.	12 Likert scale questions about the current maintenance management practices applied in building elements at engineering college building at University of Hail.
Part C Analyze and rank the factors affecting maintenance practices of engineering college building at University of Hail.	6 Likert scale questions about the factors faced in building maintenance practices at University of Hail for all participants and an interview question. AND 6 questions ONLY for the maintenance personnel about the challenges faced in building maintenance practices.

3.5.1 Timeframe

The questionnaires were administered between [14 March, 2025] to [14 April, 2025].

3.6 Method of Data Analysis

The collected quantitative data analysed using descriptive statistics such as weighted mean score (WMS), and relative important index (RII) by using Microsoft Excel 2021. This is important due to its relevance, as a questionnaire survey was used, and the research findings are measurable, quantitative, and numerical in nature. Data that cannot be represented numerically is further analysed through discussions.

To assess the current maintenance practices at the elements of engineering college building of the University of Hail, the Weighted Mean Score (WMS) will be used to determine the overall perception of respondents. The Weighted Mean Score formula is calculated as follows:

$$WMS = \frac{\sum(W \times x)}{N} \quad \textit{(1)}$$

Where:

- W = Assigned weight for each response category
- X = Frequency of responses for each category
- N = Total number of responses

Also, to identify and rank the most significant factors affecting maintenance practices, the Relative Importance Index (RII) will be used. This method helps in prioritizing factors based on respondents' ratings. The RII is calculated as follows:

$$RII = \frac{\sum(W \times X)}{A \times N} \quad \textit{(2)}$$

Where:

W = Weight assigned to each response option

X = Number of responses for each weight

A = Highest possible weight

N = Total number of responses

The results will be interpreted on a scale from 0 to 1, where a higher RII value indicates a greater perceived significance of the factor. This analysis will assist in identifying the most critical factors for improvement in maintenance practices.

Table 3-3 Research objectives and its Method of Analysis

Research Objectives	Method of Analysis
To assess the current maintenance practices in building elements at engineering college building at university of Hail.	Weighted Mean Score
To analyze the significant factors affecting the maintenance practices.	Weighted Mean Score
To rank the factors affecting the maintenance practices.	Relative Importance Index

3.7 Conclusion

This chapter has presented the research methodology adopted to investigate maintenance practices and the factors affecting at the Engineering College building of the University of Ha'il. The mixed-methods approach utilized in this study has enabled a comprehensive assessment of both quantitative and qualitative aspects of building maintenance, capturing the perspectives of various stakeholders including faculty, students, and maintenance personnel. Through purposive sampling and carefully designed research instruments, the study has gathered data that allows for meaningful analysis of current maintenance practices and the factors influencing the effectiveness.

Multiple factors affect maintenance effectiveness, including inspection regularity, response time, personnel skills, design quality, user behaviour, building age, and funding availability. The outlined analytical framework, incorporating Weighted Mean Score, and Relative Importance Index, provides a robust mechanism for assessing these factors and the relative significance. The findings derived from this methodology will contribute valuable insights for protecting physical assets while creating optimal environments for teaching and learning at the University of Ha'il.

Chapter 4: Results and Discussion

4.1 Introduction

The results and discussion chapter of this study is to provide and analyze findings from the collected data. Based on the literature review, a questionnaire was developed in which 27 questions and one interview question were asked (see Appendix A) and analyzed the quantitative and qualitative data collected from the survey questions and utilize various statistical methods to derive significant findings. This study utilized a quantitative and qualitative research approach, concentrating on numerical data and employing questionnaires to collect information regarding maintenance in the engineering college buildings at the University of Hail.

The analysis in the first Section A of the questionnaire is regards to the demographic information for knowing the background of the respondent. There are forty-four (44) of respondent among the employees (administrative staff and faculty members), maintenance personnel, students, and visitors of the engineering college occupants were participated in this questionnaire.

4.2 Demographic Information

An in-depth understanding of the demographic information of the study respondents is essential to contextualize the findings and enhance the interpretative value of the data. The following presents a data of the respondents' age distribution, gender, and the respective affiliations within the University of Ha'il. As shown in Table 4-1 below.

Table 4-1 Demographic Information

Demographic Categories	Parameter	Frequency	Percentage (%)
Age	18 - 25	8	18%
	26 - 35	16	36%
	36 - 45	17	39%
	46+	3	7%
Gender	Male	43	98%
	Female	1	2%
Affiliation with the University	Employee	11	25%
	Maintenance Personnel	16	36%
	Student	12	27%
	Visitor	5	11%

4.2.1 Age distribution

The distribution of respondents by age indicates a predominant representation of mid-career participants. Specifically, the largest proportion of participants, constituting 39%, were within the 36–45 years age range. This was closely followed by respondents aged 26–35 years, accounting for 36%. Participants aged 18–25 years comprised 18% of the sample, while age 46 years and above represented the smallest group, at 7%.

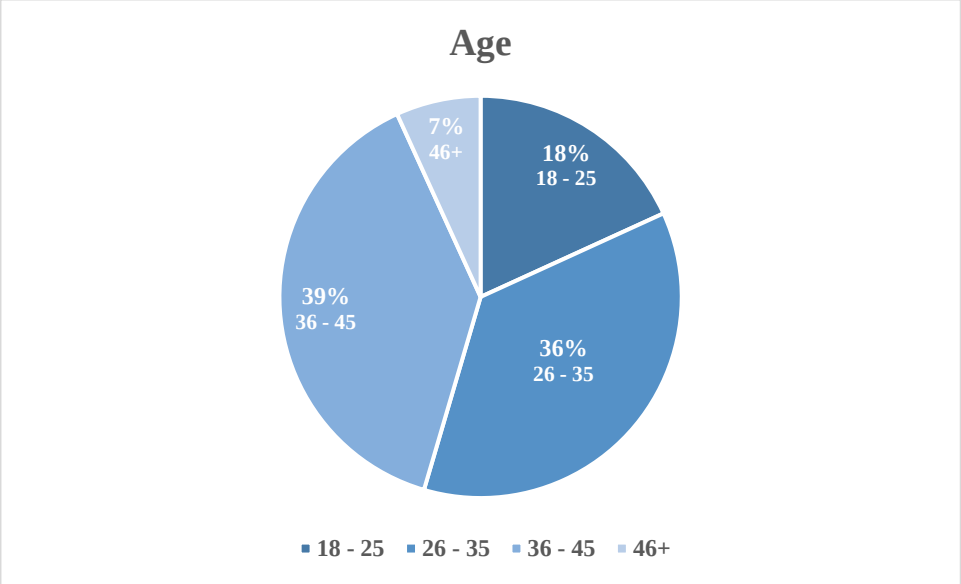

Figure 4-1 Respondents by Age

This distribution reflects a predominance of mature participants with significant professional and educational experience, especially in relation to building use and operations. The representation of the mid-age groups is especially important in the context of this study because likely to have a comprehensive understanding of the building's performance and maintenance practices. The feedback tends to be informed by both long-term observation and daily interaction with the facilities. Younger respondents, primarily students or new employees, provide insight from the user-experience perspective, while older participants offer managerial viewpoints. Overall, this age composition contributes to a rich and diverse dataset, facilitating a more rounded assessment of the existing maintenance practices

4.2.2 Gender

The gender composition of the respondents indicates that 98% were male, while 2% were female. This distribution corresponds with the staffing structure within the Engineering College, where most employees and maintenance personnel—two of the primary respondent groups—are mostly male.

This demographic distribution illustrates the workforce involved in the day-to-day operation and maintenance of educational facilities. While it may limit the diversity of perspectives to some extent, particularly in terms of end-user experience, it is considered appropriate for the scope of this research, which focuses on maintenance practices. Nonetheless, future research may benefit from exploring a more diverse respondent base to incorporate a wider range of user experiences.

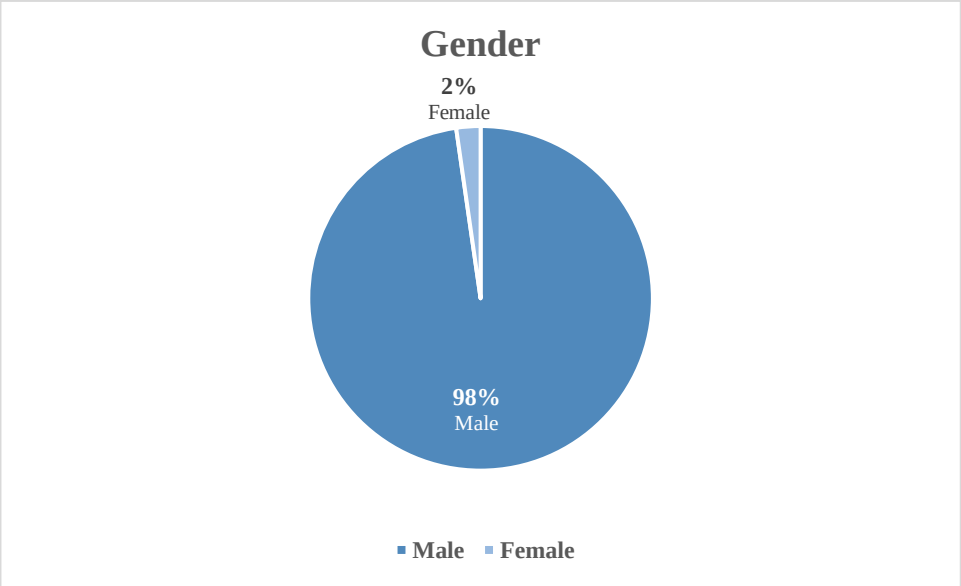

Figure 4-2 Respondents by Gender

4.2.3 Affiliation with the University

Respondents' affiliations within the university were categorized into four groups: maintenance personnel, students, employees, and visitors. The largest proportion (36%) comprised maintenance personnel, followed by students (27%), employees (25%), and visitors (11%). This distribution reflects to include both the service providers and the end-users of the university's facilities.

The substantial representation of maintenance personnel is particularly relevant, given the study's objective of assessing maintenance practices. The responses are expected to be informed by direct operational experience and technical knowledge of the procedures and challenges associated with facility upkeep. Employees—including faculty and administrative staff—offer critical insight into how maintenance practices impact workplace functionality and service delivery. The student group, as primary users of educational spaces, contribute perspectives focused on comfort, safety, and learning environment quality. Meanwhile, visitor responses, though representing a smaller subset, provide an external viewpoint that can highlight deficiencies not immediately apparent to regular occupants.

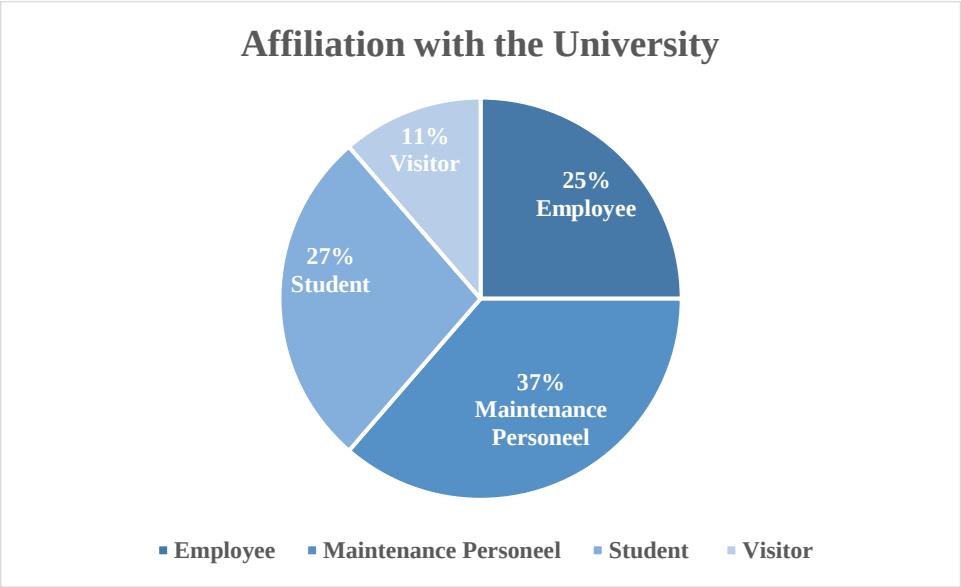

Figure 4-3 Affiliation with the University

4.3 Objective 1: to assess the current maintenance practices in building elements

The first objective of this research is to assess the current maintenance practices in building elements through the condition of various building elements within the Engineering College at the University of Hail. Data were collected using a structured questionnaire items in Section B, where respondents rated building components on a five-point Likert scale (1 = Very Bad, 2 = Bad, 3 = Average, 4 = Good, 5 = Very Good), covering physical, architectural, and mechanical elements. The collected data was analyzed using the Weighted Mean Score (WMS) method to determine the relative performance of each element. As shown in Table 4-2 below.

Table 4-2 Frequency statistic for Current Maintenance Management Practices in Building Elements.

#	System	Building element condition	Rating and Weighted Values					∑WV	WMS	Rank
			VG	G	A	B	VB			
1	Arch.	Walls	17	13	6	4	4	167	3.80	2
2	Arch	Floors	18	14	4	5	3	171	3.89	1
3	Stru.	Roofs	13	14	8	5	4	159	3.61	5
4	Arch.	Openings	14	15	8	4	3	165	3.75	3
5	Arch.	Furniture	13	14	7	5	5	157	3.57	6
6	Mech.	HVAC systems	10	13	8	5	8	144	3.27	10
7	Elec.	Electrical Systems	13	14	8	6	3	160	3.64	4
8	Mech.	Elevators	10	11	8	7	8	140	3.18	11
9	Mech.	Environmental Sanitation	8	16	9	6	5	148	3.36	9
10	Mech.	Watter Supply	12	14	5	8	5	152	3.45	8
11	Arch.	Rainwater Drainage	14	11	7	7	5	154	3.50	7
12	-	Overall Building Condition	9	19	7	4	5	155	3.52	-

1. Walls, respondents were asked to assess the condition of walls, including interior and exterior finishes, surface integrity, and paint quality. The resulting WMS of 3.80 indicates that walls are generally perceived to be in good condition. This suggests effective routine maintenance, surface treatment, and minimal structural damage.

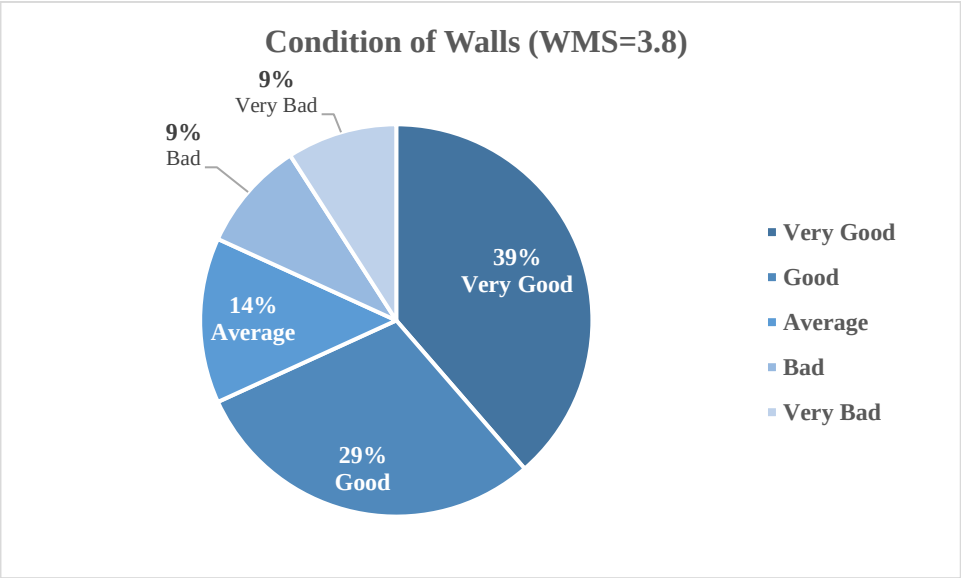

Figure 4-4 Condition of Walls by Respondents

2. Floors, participants rated floor finishes such as tiles and carpeting. This element received the highest WMS score of 3.89, suggesting that flooring is well-maintained. High floor ratings are associated with frequent cleaning schedules and effective surface material selection, especially in high-traffic academic environments.

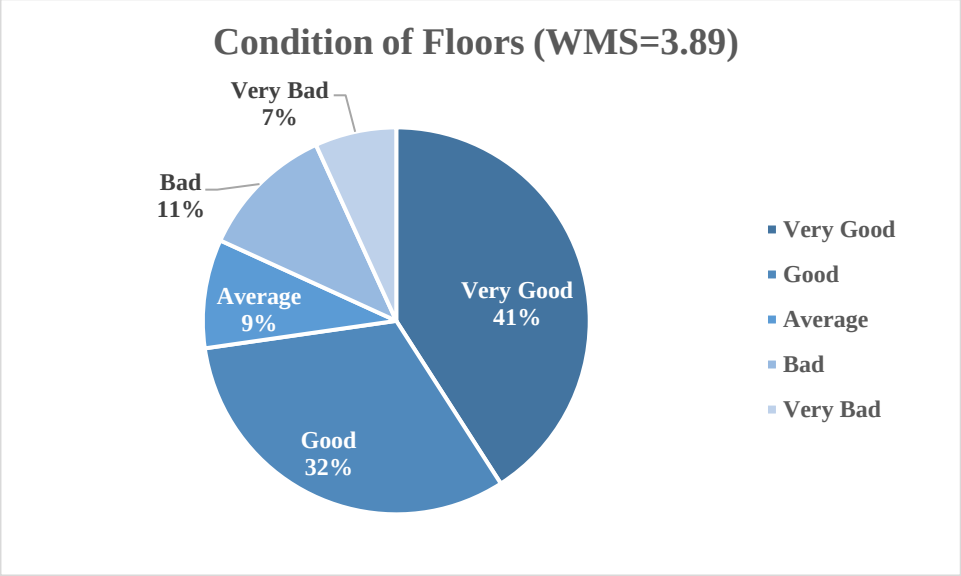

Figure 4-5 Condition of Floors by Respondents

3. Roofs, the question related to roof conditions, including ceiling finishes and structural slabs. The WMS of 3.61 indicates a moderately positive perception. While not among the lowest, this score might reflect minor leakage issues or aging finishes that have not reached critical failure but require future attention to prevent deterioration.

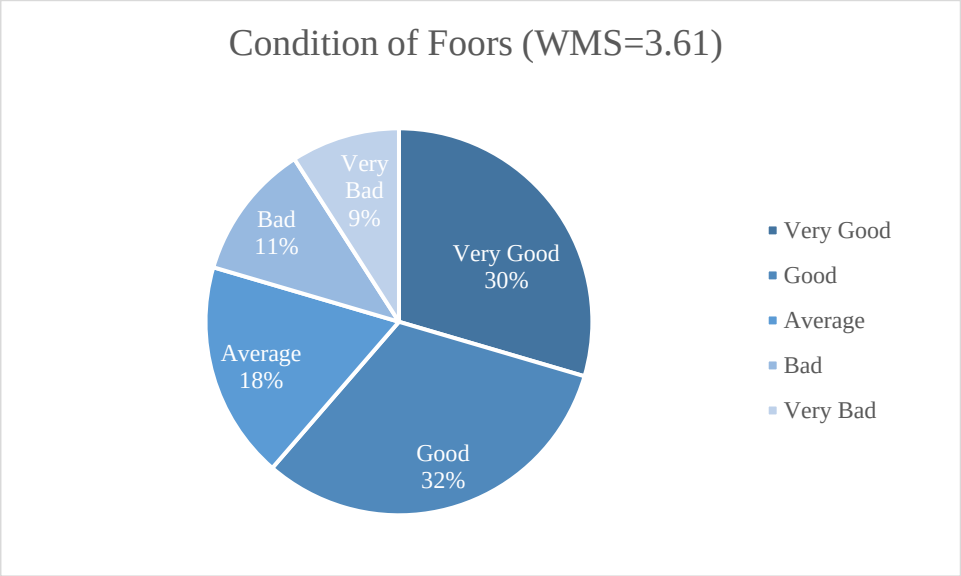

Figure 4-6 Condition of Roofs by Respondents

4. Openings, respondents assess the functionality and condition of openings, encompassing doors, windows, hinges. The WMS of 3.75 indicates that these components are generally functional and well-maintained. Proper functioning of openings is critical to safety, ventilation, and accessibility, and this score suggests acceptable maintenance of these operational features.

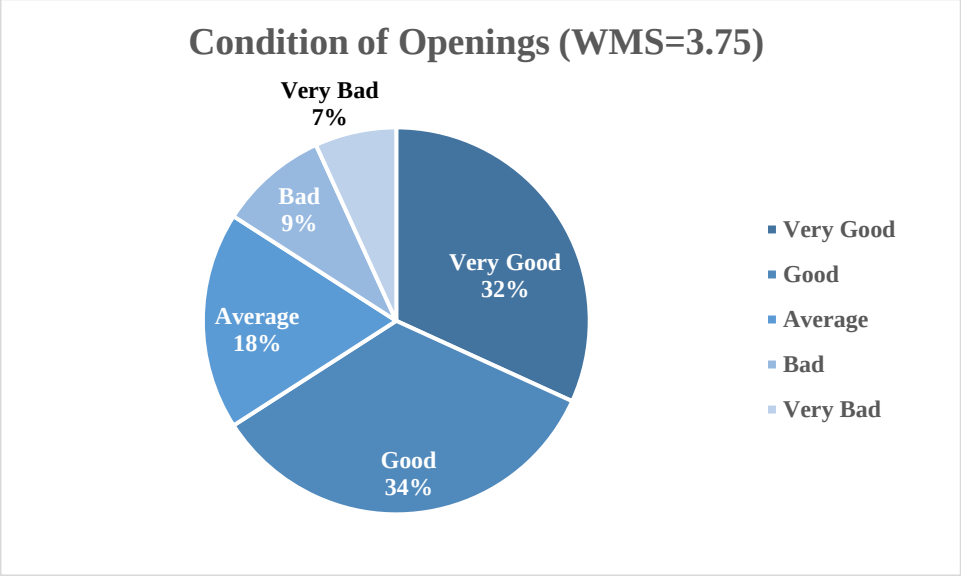

Figure 4-7 Condition of Openings by Respondents

5. Furniture, including chairs, desks, and whiteboards, were also assessed. With a WMS of 3.57, the results suggest that while the furniture is generally in usable condition, some items may exhibit signs of wear or uncomfortable seatings. The score reflects an average satisfaction level and highlights the potential for phased replacement or refurbishment.

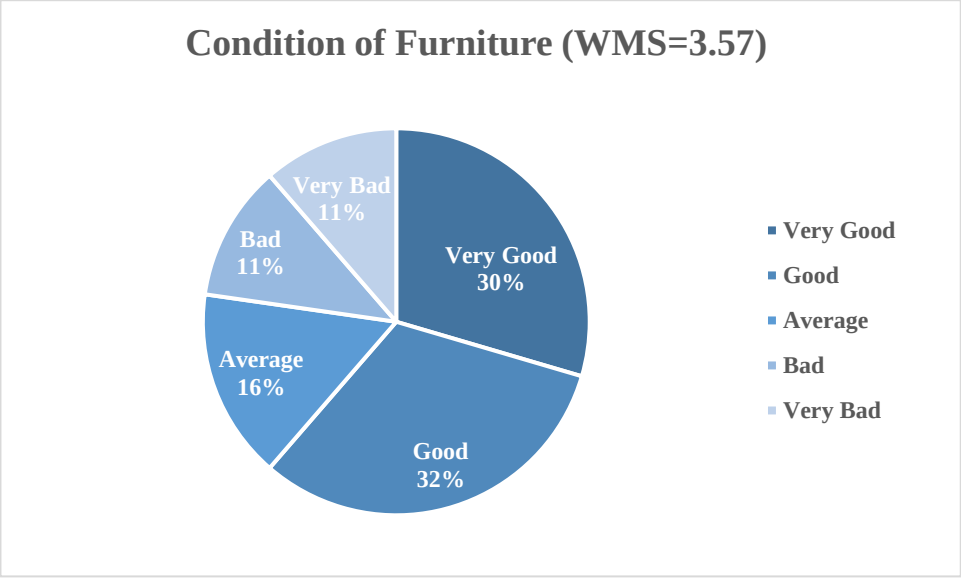

Figure 4-8 Condition of Furniture by Respondents

6. HVAC system and indoor air quality, Respondents were asked to evaluate the heating, ventilation, and air conditioning (HVAC) systems, particularly the performance during seasonal changes and the influence on indoor air quality. This component scored a WMS of 3.27, reflecting concerns related to the set temperature. Given the importance of thermal comfort in learning environments, this low score identifies HVAC systems as a priority area for maintenance planning.

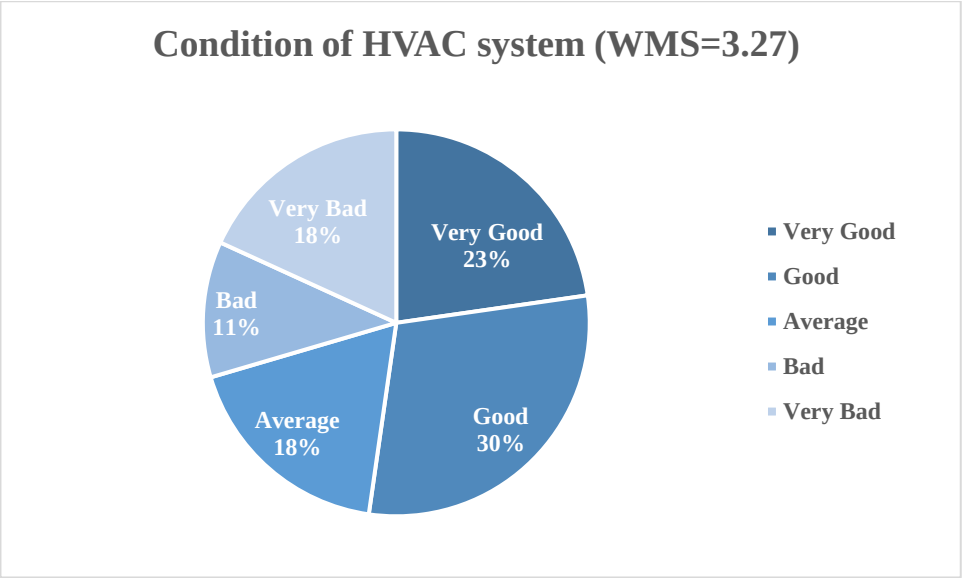

Figure 4-9 Condition of HVAC system by Respondents

7. Electrical system, question focused on artificial lighting, outlet functionality, and switch operation. A WMS of 3.64 suggests that electrical systems are relatively stable and meet user needs. However, the score does not indicate excellence, implying that periodic inspections and upgrades are still warranted.

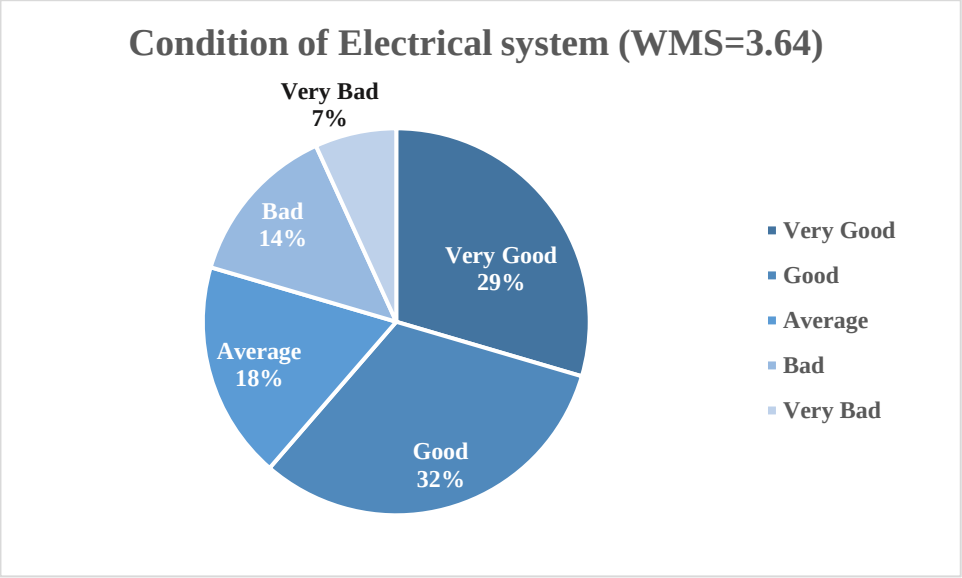

Figure 4-10 Condition of Electrical system by Respondents

8. Elevators, participants assessed the availability and reliability of elevators, including issues related to downtime and service frequency. Elevators received the lowest WMS score of 3.18, pointing to significant dissatisfaction. Frequent breakdowns or extended service interruptions could be undermining accessibility and convenience, especially for the with mobility needs. This result identifies elevator maintenance as a critical and urgent concern.

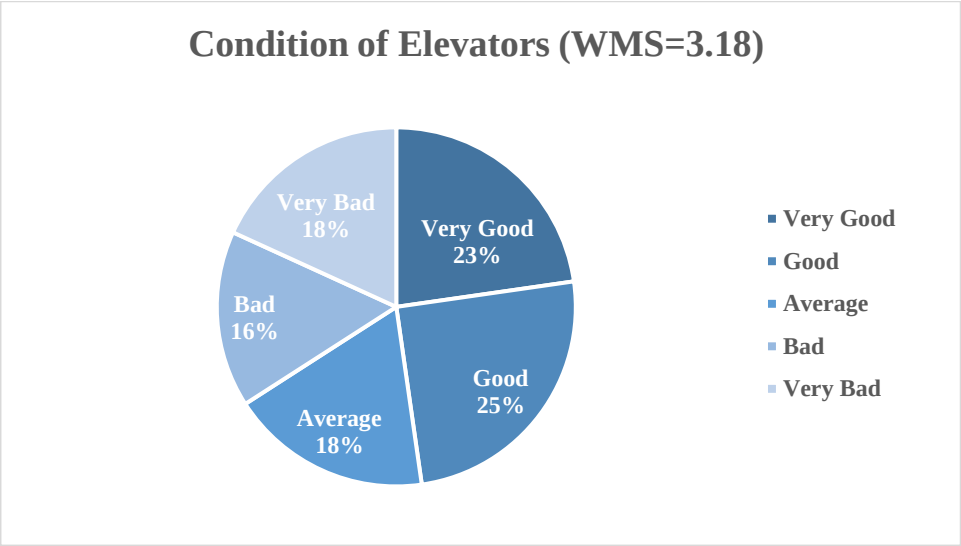

Figure 4-11 Condition of Elevators by Respondents

9. Environmental sanitation, this item assesses the cleanliness of floors, glass, restrooms, and disinfection routines. The WMS of 3.36 indicates moderate satisfaction, Cleanliness plays a key role in health and comfort, especially in high-traffic academic spaces, thus calling for improved oversight in sanitation services.

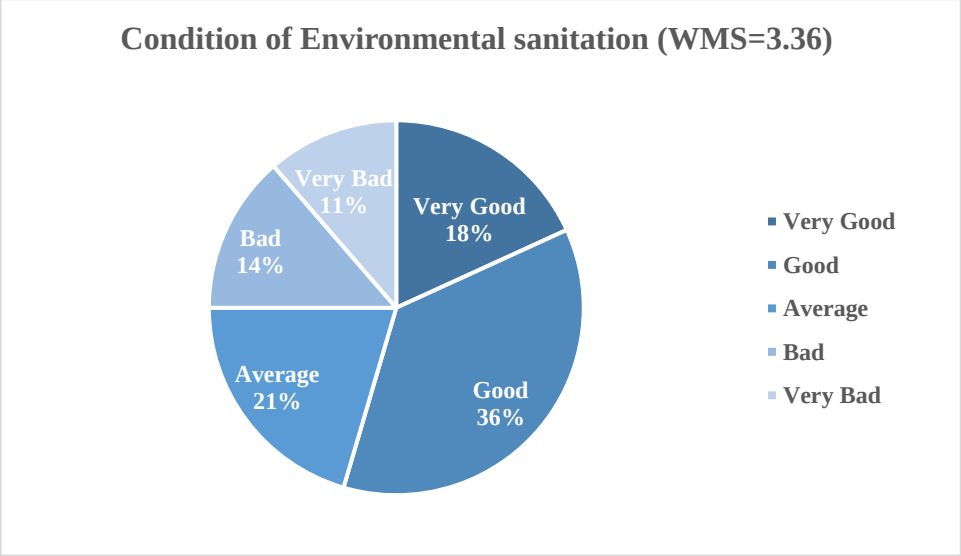

Figure 4-12 Condition of Environmental sanitationby Respondents

10. Water supply, participants rated the availability, pressure consistency, quality, and fixture maintenance of the water supply systems. The WMS of 3.45 indicates that while water service is largely adequate, there may be sporadic issues related to pressure drops, fixture malfunctions, or perceptions of water quality.

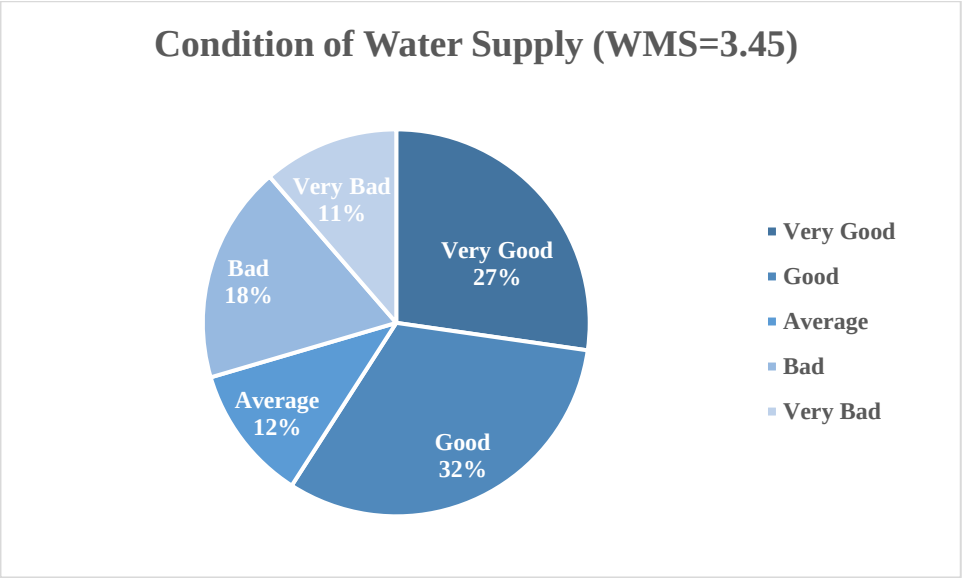

Figure 4-13 Condition of Water supply by Respondents

11. Rainwater drainage, this component concerned the effectiveness of the drainage system, particularly its performance during heavy rainfall. With a WMS of 3.50, respondents indicated moderate satisfaction, suggesting that while heavy rainfall is not a frequent issue, capacity limitations may arise during intense storms. This highlights the importance of preventive cleaning and drainage system inspections.

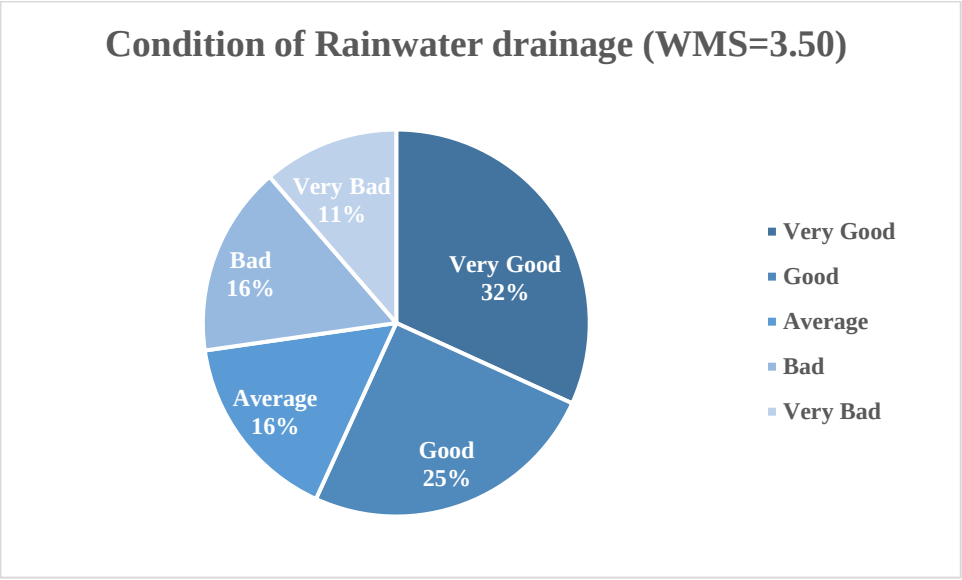

Figure 4-14 Condition of Rainwater Drainage by Respondents

12. Overall building condition, finally, respondents were asked to evaluate the overall condition of the building. The WMS for this item was 3.52, suggesting a general perception of adequacy. While not negative, this score implies that while core functions are being met, several areas could benefit from systematic improvement.

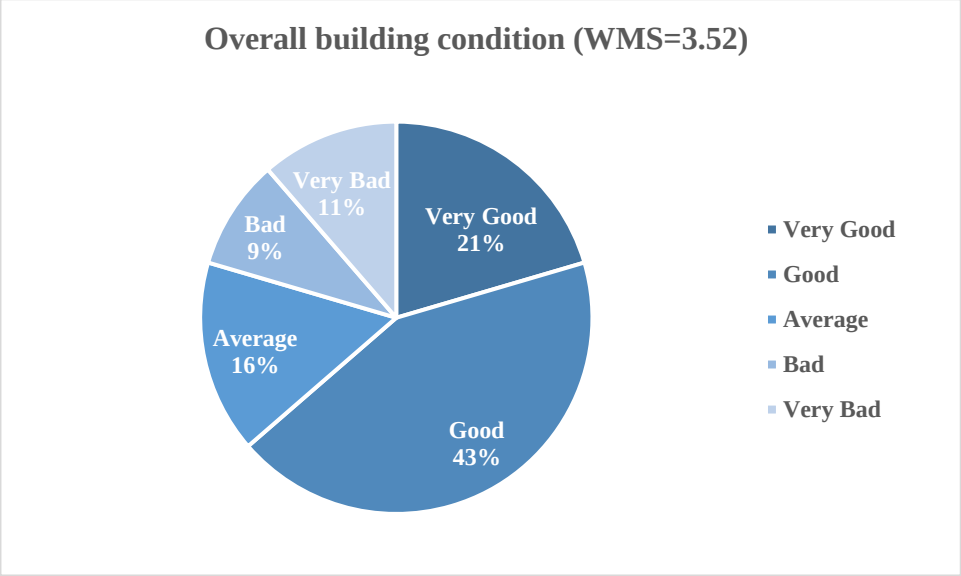

Figure 4-15 Overall building condition by Respondents

The analysis of section B in questionnaire responses reveals a moderate to good overall condition of the Engineering College building. Structural and architectural components such as walls, floors, and openings are perceived positively, likely due to the routine visibility and prioritization in basic maintenance. However, mechanical systems—especially the HVAC and elevator systems—received relatively low scores, highlighting deficiencies in preventive maintenance, system aging, or resource constraints. The findings underscore the need for a strategic and data-driven maintenance plan, focusing on underperforming areas while maintaining the satisfactory performance of existing well-rated elements.

4.4 Objective 2 and 3: to analyze and rank the significant factors affecting the maintenance practices

This section presents the results related to the research Objectives 2 and 3. Objective 2 addresses to analyze the significant factors affecting the maintenance practices, while Objective 3 focuses to rank the factors affecting the maintenance practices. The findings are based on responses gathered through structured questionnaires in section C and C2. Each of the 12 factors was rated using a 5-point Likert scale ranging from “Very Low” (1) to “Very High” (5). The analysis utilized Weighted Mean Score (WMS) and Relative Importance Index (RII) to rank and determine the significance of each factor. The first six factors in section C were presented to all participants (faculty members, administrative staff, maintenance personnel, students and visitors) while the last six factors in section C2 were specifically asked to maintenance personnel, as representing direct operational challenges and technical nature. As shown in Table 4-3.

Table 4-3 Frequency statistic for Factors Affecting Maintenance Practices

SEC	#	Factor	Rating and Weighted Values					∑WV	WMS	RII	Rank
			VH	H	A	L	VL				
Section C All Participants	1	Delayed response time to maintenance requests	17	12	8	4	3	168	3.8182	0.7636	3
	2	Absence of user satisfaction evaluation	17	14	8	3	2	173	3.9318	0.7864	1
	3	Unskilled maintenance personnel	18	9	10	4	3	167	3.7955	0.7591	4
	4	Improper use or misuse of building	12	17	8	3	4	162	3.6818	0.7364	5
	5	High occupant density	15	10	7	7	5	155	3.5227	0.7045	6
	6	lack of regular inspection and maintenance	18	13	6	3	4	170	3.8636	0.7727	2
Section C2 ONLY Maintenance Personnel	7	Faulty design	10	3	2	0	1	69	4.3125	0.9200	1
	8	Building age	6	6	2	0	2	62	3.8750	0.8267	4
	9	Unavailability of Skilled Maintenance Personnel	7	5	2	1	1	64	4.0000	0.8533	3
	10	Inaccurate As-Built Drawings	8	4	2	1	1	65	4.0625	0.8667	2
	11	Lack of Funding	8	7	0	0	1	69	4.3125	0.9200	1
	12	Lack of Adoption of Building Information Modeling (BIM)	7	7	2	0	0	69	4.3125	0.9200	1

The results of all the participants in section C:

Among the general factors affecting maintenance practices, the absence of user satisfaction evaluation was ranked 1st among all participants (WMS = 3.93; RII = 0.79). Respondents reported that without structured mechanisms to gather user feedback, maintenance teams are often unaware of service gaps, user concerns, or priorities. This limits the ability to improve performance based on actual needs and expectations.

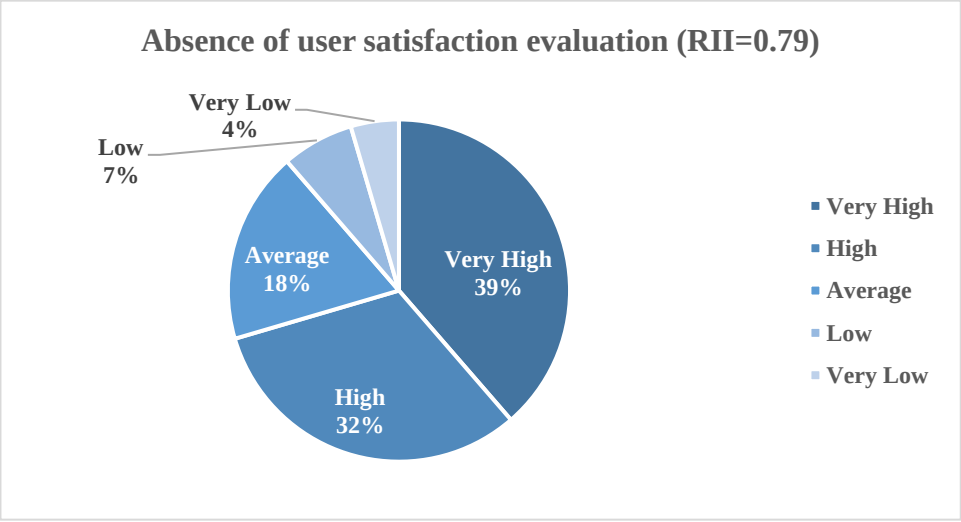

Figure 4-16 Absence of user satisfaction evaluation factor results

Ranked 2nd among all participants was the lack of regular inspection and planned maintenance (WMS = 3.86; RII = 0.77). The results indicate that maintenance at the Engineering College is largely reactive. Many small defects escalate due to lack of

periodic inspections and structured maintenance routines, might lead to higher costs and preventable disruptions.

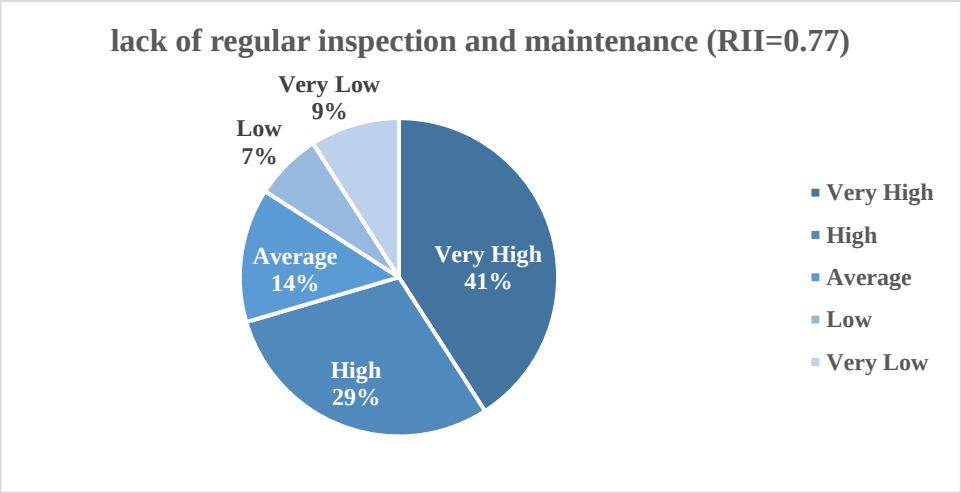

Figure 4-17 lack of regular inspection and maintenance factor results

The delayed response time to maintenance requests (WMS = 3.818; RII = 0.763) 3rd and the presence of unskilled maintenance personnel (WMS = 3.795 and 3.759) 4th ranking of among all participants. Respondents expressed dissatisfaction with the time it takes to resolve reported issues and emphasized that delays are worsened by a lack of technical expertise. These two factors highlight the need for a faster, more competent, and better-managed maintenance response system.

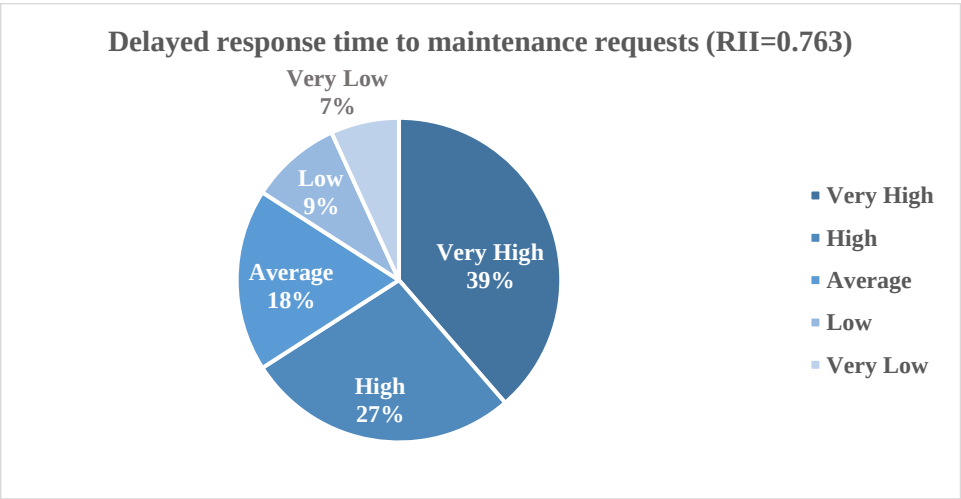

Figure 4-18 Delayed response time to maintenance requests factor results

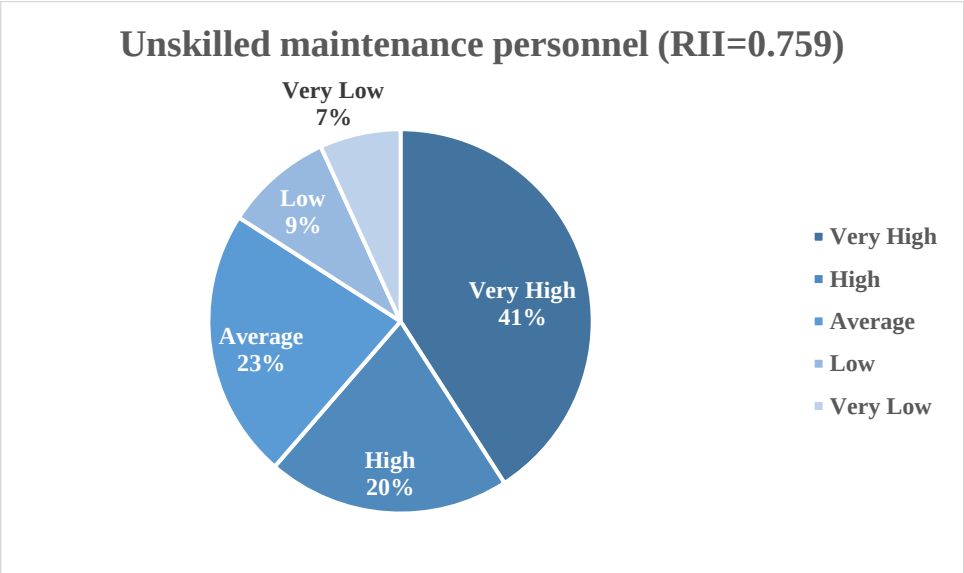

Figure 4-19 Unskilled maintenance personnel factor results

The improper use or misuse of building facilities was ranked 5th among all participants (WMS = 3.68; RII = 0.74). and lastly, high occupant density was ranked 6th (WMS = 3.52; RII = 0.70). Respondents reported that have a limited effect on shared spaces places.

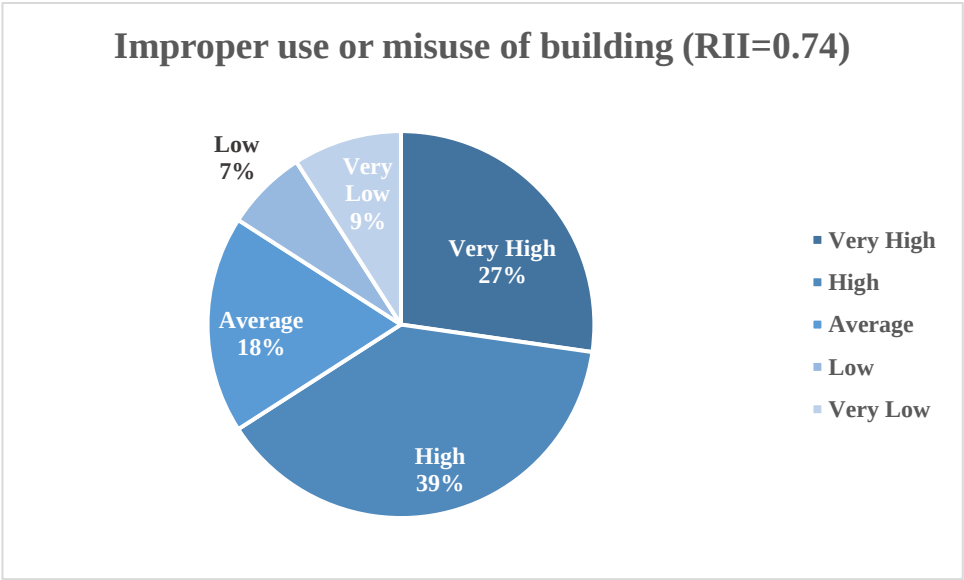

Figure 4-20 Improper use or misuse of building factor results

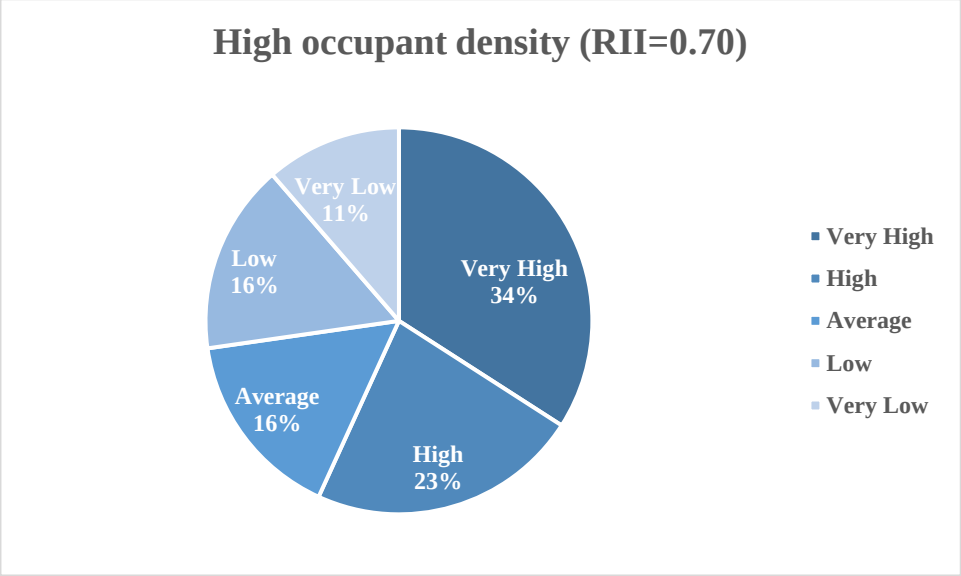

Figure 4-21 High occupant density factor results

Turning to the results from maintenance personnel in section C2:

The most critical challenges, jointly ranked 1st, were lack of funding, and lack of adoption of Building Information Modeling (BIM), and faulty design each with an identical WMS of 4.31 and RII of 0.92. Faulty design might address in unavailable materials, and overly complex layouts or unavailable of local replacement material. The absence of BIM hinders accurate documentation and tracking of facility components, while insufficient funding affects timely repairs, equipment procurement, and preventive maintenance.

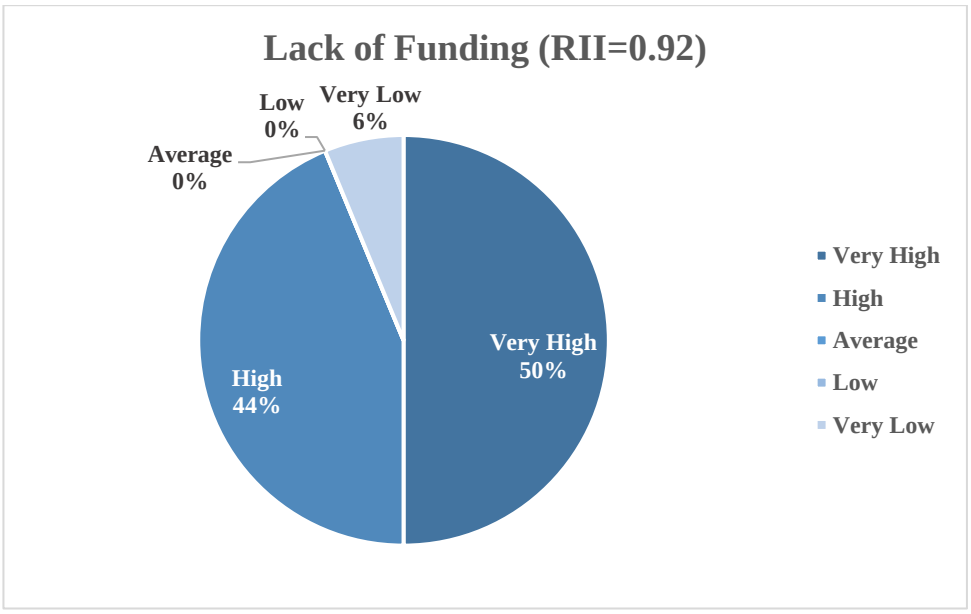

Figure 4-22 Lack of Funding factor results

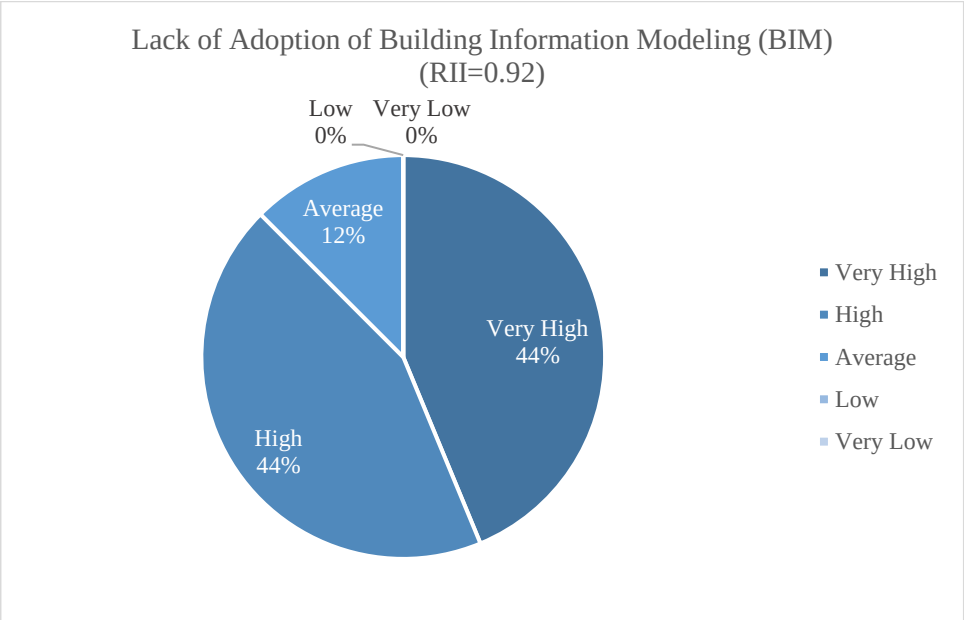

Figure 4-23 Lack of Adoption of Building Information Modeling (BIM) factor results

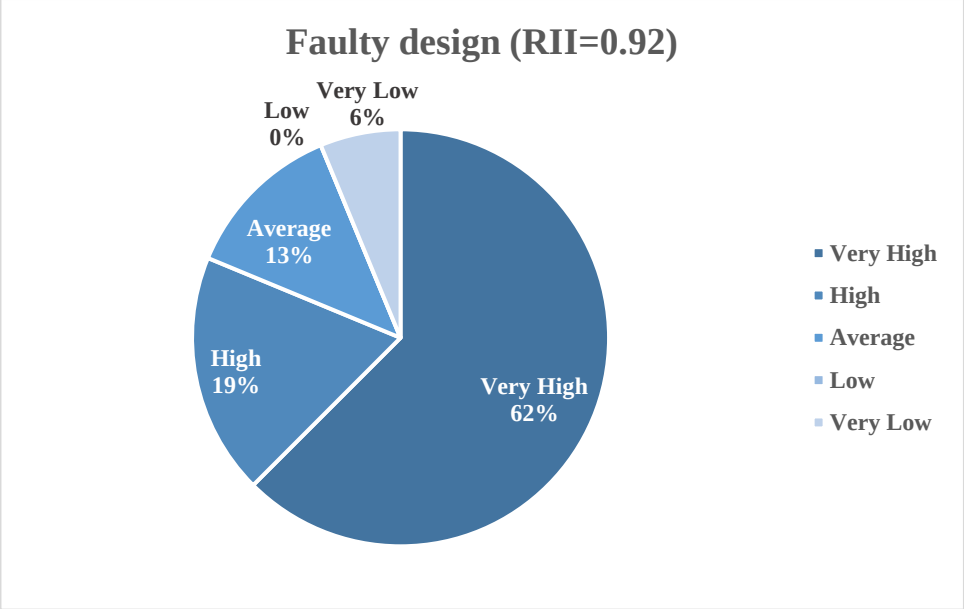

Figure 4-24 Faulty design factor results

Inaccurate As-Built Drawings was ranked 2nd (WMS = 4.06; RII = 0.87). Lacking detailed technical documentation might affect incomplete knowledge of the building's systems, leading to delays and increased risk of error during repairs.

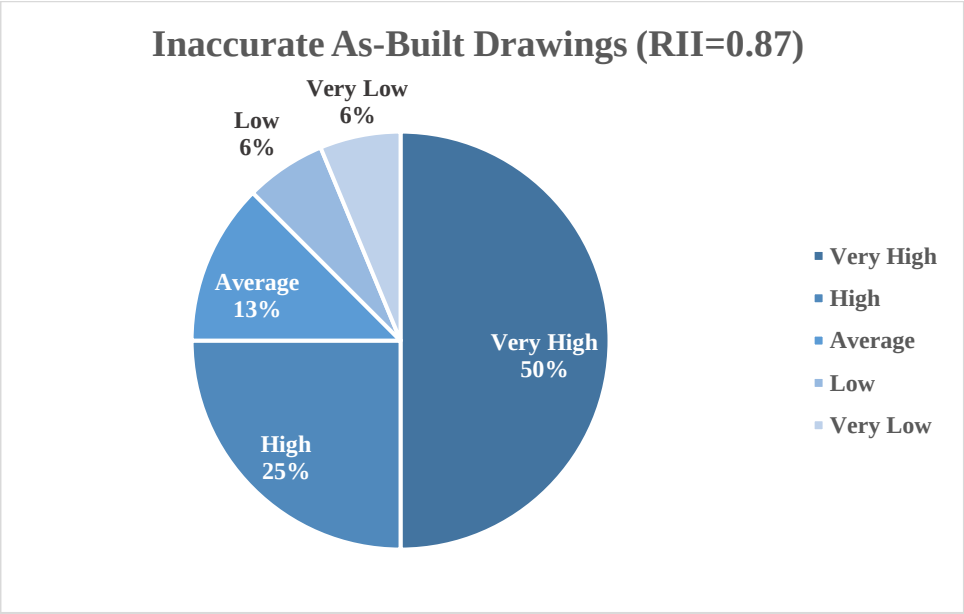

Figure 4-25 Inaccurate As-Built Drawings factor results

Unavailability of skilled maintenance personnel was ranked 3rd (WMS = 4.00; RII = 0.85). Despite the awareness of tasks, the shortage of qualified staff continues to affect the timeliness and quality of maintenance work. Upskilling and workforce development are therefore necessary to improve service performance.

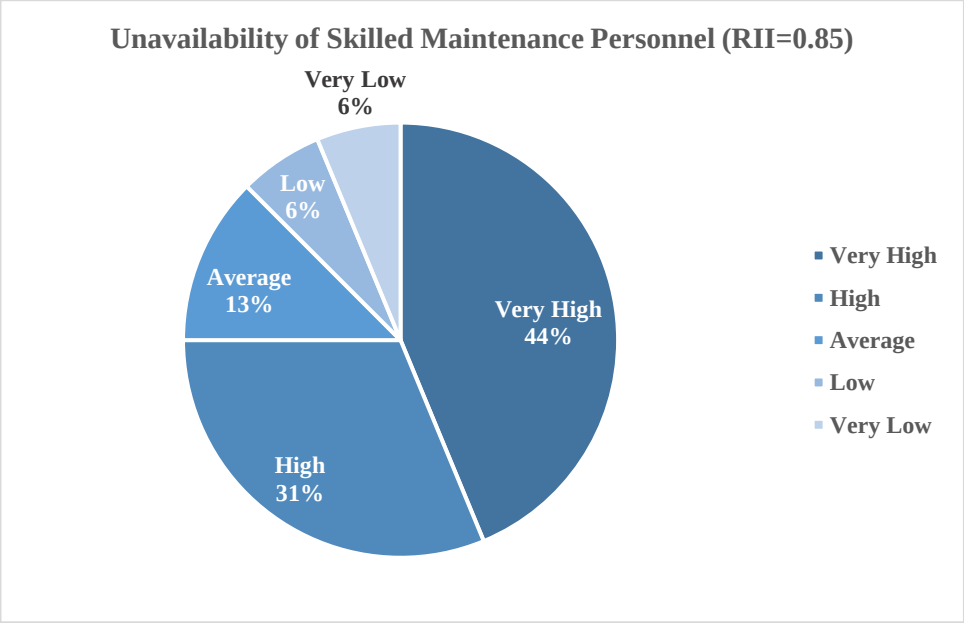

Figure 4-26 Unavailability of Skilled Maintenance Personnel factor results

Building age was ranked 4th (WMS = 3.88; RII = 0.83). representing the lowest rank.

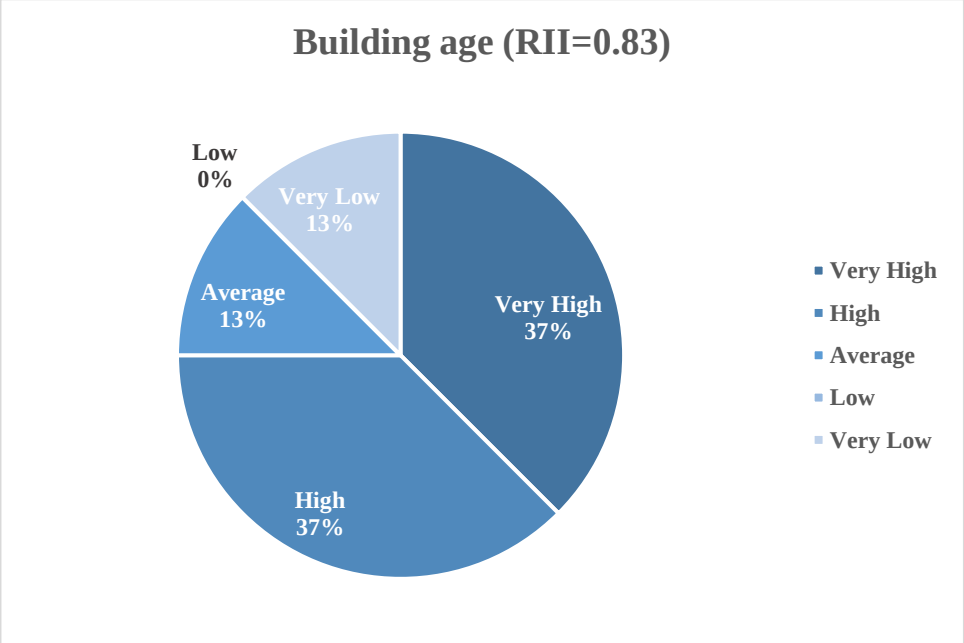

Figure 4-27 Building age factor results

4.4.1 Qualitative Responses on the Effectiveness of Maintenance Practices

In addition to the structured questions in the survey, a final open-ended item was included to capture personal insights from respondents regarding the effectiveness of the current maintenance practices in building elements implemented at the Engineering College of the University of Hail. The question asked: In your opinion, kindly describe how effective the current maintenance practices implemented on the Engineering College building at the University of Hail, and what factors do you believe have the most significant effect?

A total of 15 of 44 responses were answered with the question. The answers were provided in Arabic and have been translated into English for the purpose of thematic analysis and reporting. Qualitative feedback adds depth to the survey findings by highlighting real experiences, personal observations, and recommendations for improvement.

1. General Perception of Effectiveness

Several respondents rated the current maintenance practices as moderately effective or partially effective. Others described as ineffective, citing lack of organization, prolonged system failures, and inadequate oversight. For instance, one respondent noted: "Inefficient and there is no apparent preventative maintenance plan... The elevator has not been in operation for a long time.". This indicates that preventive maintenance is either weak or absent, and corrective actions are often delayed, especially in the case of elevator breakdowns.

2. Issues related to the mechanical systems

Elevators were the most frequently mentioned issue, with respondents reporting frequent breakdowns and long periods of inactivity without repair: “The elevators break down periodically…and stay out of service for days and weeks.”

Heating and ventilation and air conditioning (HVAC) also drew negative comments. Some users reported uncomfortable conditions due to excessively cold air and temperature imbalance between inside and outside: "The HVAC system is too cold... It affects the body when you go out into the hot weather."

3. Technical Gaps

A few responses highlighted deeper systemic and technical concerns:

Respondent emphasized the need for activation of the BMS (Building Management System): "BMS system activation. The system is not active in the College of Engineering building."

Understaffing was mentioned as a barrier to quality service: "The personnel is low."

Lack of advanced maintenance systems or automation was noted: "Lack of automation and advanced maintenance systems resulting in poor quality of service."

Overall, the open-ended responses reveal that while some maintenance practices are appreciated, there is a clear demand for more consistent, proactive, and professionally managed services. Key concerns include elevator reliability, HVAC comfort, restroom hygiene, furniture usability, and the need for system modernization. These insights align with the quantitative results and reinforce the call for a more strategic, responsive, and digitally enabled maintenance approach in the college facility.

4.5 Discussion of Findings

This section discusses the main findings of the study in light of the research objectives. It brings together both quantitative results and qualitative insights gathered through the questionnaire. The discussion highlights key issues related to the effectiveness of current maintenance practices, the factors influencing, and the challenges faced by the maintenance team at the Engineering College building of the University of Hail.

The assessment of building elements revealed that the general condition of the structure and finishes—such as floors and walls—is perceived to be relatively good. Floors received the highest weighted mean score (WMS = 3.89), followed by walls and

openings, suggesting that the aesthetic and structural components are in good condition. However, this positive perception did not extend to service systems. Mechanical elements like elevators (WMS = 3.18) and HVAC systems (WMS = 3.27) were rated poorly, reflecting dissatisfaction with the reliability and performance. These findings suggest that while some aspects of the building receive consistent attention, others—particularly operational and comfort-related systems—are neglected or lack preventive maintenance.

The results of all participants from the factor ranking offer further clarity on what affects maintenance effectiveness. Among all respondents, the absence of user satisfaction evaluation was ranked as the most important factor influencing maintenance practices. This indicates that users feel concerns are not actively considered in planning or service delivery. The lack of regular inspection and planned maintenance was the second highest-ranked factor, revealing that much of the maintenance work appears to be reactive rather than preventive. Such an approach often leads to higher costs, delayed responses, and recurring problems—especially for high-use components such as elevators and restrooms.

From the perspective of maintenance personnel, several systemic challenges were ranked highest, including faulty design, lack of funding, and the absence of BIM (Building Information Modeling). These three factors shared the top rank. de. Likewise, insufficient budgets limit the ability to respond quickly, procure necessary parts, or adopt modern technologies. The lack of BIM, in particular, was highlighted as a key missing tool that would otherwise allow for more efficient planning, documentation, and tracking of facility assets.

The open-ended responses provided additional insights and validated many of the concerns raised in the quantitative sections. Most participants expressed moderate to low satisfaction with the current maintenance practices. Several reported issues with elevators being out of service for extended periods, air conditioning being uncomfortably cold in transitional seasons, and restrooms lacking proper upkeep. One of the recurring suggestions was the need to improve classroom seating, indicating that furniture comfort is also an overlooked area. Additionally, participants called for increased staffing, routine maintenance, and the activation of smart systems like the Building Management System (BMS). The absence of automation and the limited number of technicians were commonly cited as barriers to improved service delivery.

4.6 Conclusion

In conclusion, while the maintenance practices in the Engineering College building demonstrate strengths in certain areas, several weaknesses remain—especially in managing mechanical systems, applying preventive maintenance, and integrating modern tools. Addressing these gaps requires a combination of better planning, skilled personnel, appropriate funding, and the implementation of digital systems. The findings of this study reinforce the need for a more proactive, well-resourced, and user-centered approach to maintenance management in educational facilities.

Chapter 5: Conclusion and Future Work

This research has assessed the current maintenance practices in building elements and identified and rank the key factors influencing building maintenance effectiveness at the Engineering College building of the University of Hail. By employing a mixed-methods approach that incorporated both quantitative and qualitative data collection, the study was able to deliver an assessment of maintenance practices, and challenges from the perspectives of both users and maintenance personnel.

The findings revealed that while the general structural and architectural elements—such as floors, walls, and openings—are perceived to be in relatively good condition, there are a significant concern with services like elevators and HVAC systems. These services received the lowest scores, indicating issues such as delayed response time, insufficient preventive maintenance, and possible budgetary or operational constraints.

Furthermore, the analysis of influential factors identified several key issues, including the absence of user satisfaction evaluation, lack of regular inspection, delayed response time, and unskilled personnel. Maintenance personnel further highlighted technical and managerial barriers, such as inaccurate as-built drawings, lack of Building Information Modeling (BIM) adoption, and insufficient funding.

These challenges were corroborated by open-ended qualitative responses, which consistently pointed to elevator failures, inconsistent air conditioning, inadequate restroom maintenance, and uncomfortable lecture-seating furniture.

The study concludes that although maintenance practices are functioning to a moderate degree, there is a need for a more proactive, structured, and resource-supported approach. Investment in training, proper inspection routines, smart building systems like BMS, and user feedback mechanisms are essential for sustaining facility performance and meeting the evolving needs of building users.

5.1 Recommendations for future work

While this study has provided important insights, several opportunities exist for future research and development in this field:

Expansion to Other University Facilities: This research focused solely on the Engineering College building. Future studies could include multiple buildings across different faculties and campuses to develop a more comprehensive understanding of maintenance practices at the institutional level.

Longitudinal Studies: Conducting a longitudinal assessment over multiple years would help track improvements, seasonal effects, and the long-term impact of any new maintenance strategies or technologies implemented, such as the adoption of preventive maintenance schedules, the use of Building Information Modeling (BIM) for facility management, energy-efficient HVAC upgrades, or improved staff training programs.

BIM and Smart Maintenance Systems: Future research could explore the integration of digital tools, such as Building Information Modeling (BIM) and Building Management Systems (BMS), in optimizing maintenance planning, tracking, and execution. Pilot projects could be studied to measure cost-effectiveness and user satisfaction.

Development of a Maintenance Performance Index (MPI): Building on the current methodology, a more advanced performance assessment tool could be developed to benchmark and score facility maintenance using multiple KPIs, such as response time, failure rate, occupant satisfaction, and budget compliance.

Sustainability and Energy Efficiency Factors: Given global trends toward sustainable campuses, future studies could assess how maintenance practices intersect with energy conservation goals and sustainable design, helping reduce carbon emissions and operating costs.

In conclusion, this study not only highlights the current challenges of maintenance practices at educational facilities but also sets the groundwork for strategic improvements. The findings serve as a guide for institutional decision-makers seeking to enhance facility performance, user satisfaction, and long-term asset value.

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Appendix A: Questionnaires

SurveyHero

Assessment of Maintenance Practices for Education Building Facilities: A Case Study of University

تقييم ممارسات الصيانة لمرافق المباني التعليمية: دراسة حالة بجامعة حائل
Assessment of Maintenance Practices for Education Building Facilities: A Case Study of University of Hail

أهلا وسهلا بكم، تسرني مساهمتكم في هذا الاستبيان. **يستغرق حوالي 2 -3 دقائق**، عبارة عن 3 اقسام (معلومات عامة، تقييم ممارسات الصيانة، العوامل التي قد تؤثر على ممارسات الصيانة)
لا يقوم هذا الاستبيان بجمع أي معلومات شخصية مثل الأسماء أو عناوين البريد الإلكتروني أو أرقام الهواتف. ستظل جميع الإجابات مجهولة الهوية وستستخدم فقط لأغراض البحث العلمي
يعد هذه الاستبيان جزءًا من دراسة بحثية بعنوان "تقييم ممارسات الصيانة لمرافق المباني التعليمية: دراسة حالة بجامعة حائل". تهدف الدراسة إلى تقييم ممارسات الصيانة الحالية **في مبنى كلية الهندسة بجامعة حائل**، والعوامل التي قد تؤثر على ممارسات الصيانة.

Welcome! I am pleased to have your participation in this survey. It **takes approximately 2-3 minutes** and consists of three sections: General Information, Maintenance Practices Assessment, and Factors Affecting Maintenance Practices.
This survey does not collect any personal information such as names, email addresses, or phone numbers. All responses will remain anonymous and will be used solely for research purposes.
This survey is part of the research study titled "Assessment of Maintenance Practices for Education Building Facilities: A Case Study of University of Hail." The study aims to assess the current maintenance practices **in the engineering building at the University of Hail**, and factors that might affecting the maintenance practice

قسم أ: معلومات عامة
Section A: General Information

العمر:
Age: *

- ◯ 18 - 25
- ◯ 26 - 35
- ◯ 36 - 45
- ◯ 46+

الجنس:
Gender: *

- ◯ Male - ذكر
- ◯ Female - انثى

الإنتماء إلى الجامعة:
Affiliation with the University: *

- ◯ موظف-ـة (عضو هيئة تدريس او موظف اداري)
  Employee (Faculty Member, Administrative Staff)
- ◯ موظف صيانة
  Maintenance Personnel
- ◯ طالب-ـة
  Student
- ◯ زائر
  Visitor

قسم ب: ممارسات الصيانة لعناصر مبنى كلية الهندسة في جامعة حائل
Section B: Maintenance Practices on the elements of engineering college building

(يرجى الإشارة إلى حالة عناصر المبنى التالية من خلال اختيار الإجابة المناسبة. حيث (5= جيد جدًا، 4= جيد، 3= متوسط، 2= سيء، 1= سيء جدًا
Kindly indicate the condition of the following building elements by select the appropriate answer. Where (5=very good, 4=good, 3=Average, 2=Bad, 1=Very Bad)

من خلال تجربتك، يرجى الإشارة إلى حالة الجدران (على سبيل المثال، الجدران الداخلية والخارجية، تشطيبات الجدران، حالة الطلاء) من خلال اختيار الإجابة المناسبة
In your experience, please indicate the condition of the Walls (e.g., interior and exterior walls, wall finishes, paint condition) by select the appropriate answer. *

- ◯ Very Good = 5 = جيد جدًا
- ◯ Good = 4 = جيد
- ◯ Average = 3 = متوسط
- ◯ Bad = 2 = سيء
- ◯ Very Bad = 1 = سيء جدًا

من خلال تجربتك، يرجى الإشارة إلى حالة الأرضيات (على سبيل المثال، التشطيبات السطحية، والبلاط، والسجاد) من خلال اختيار الإجابة المناسبة
In your experience, please indicate the condition of the Floors (e.g., surface finishes, tiles, Carpets) by select the appropriate answer. *

- ◯ Very Good = 5 = جيد جدًا
- ◯ Good = 4 = جيد
- ◯ Average = 3 = متوسط
- ◯ Bad = 2 = سيء
- ◯ Very Bad = 1 = سيء جدًا

من خلال تجربتك، يرجى الإشارة إلى حالة الأسقف (على سبيل المثال، تشطيبات السقف، والبلاطة الهيكلية) من خلال اختيار الإجابة المناسبة
In your experience, please indicate the condition of the Roofs (e.g., ceiling finishes, structural slab) by select the appropriate answer. *

- ◯ Very Good = 5 = جيد جدًا
- ◯ Good = 4 = جيد
- ◯ Average = 3 = متوسط
- ◯ Bad = 2 = سيء
- ◯ Very Bad = 1 = سيء جدًا

من خلال تجربتك، يرجى الإشارة إلى حالة الفتحات (الأبواب والنوافذ، على سبيل المثال، الوظائف والصيانة) من خلال اختيار الإجابة المناسبة
In your experience, please indicate the condition of the Openings (Doors and windows e.g., functionality, maintenance) by select the appropriate answer. *

- ◯ Very Good = 5 = جيد جدًا
- ◯ Good = 4 = جيد
- ◯ Average = 3 = متوسط
- ◯ Bad = 2 = سيء
- ◯ Very Bad = 1 = سيء جدًا

من خلال تجربتك، يرجى الإشارة إلى حالة الأثاث (على سبيل المثال، الكراسي، والسبورة البيضاء، والمكاتب) من خلال اختيار الإجابة المناسبة
In your experience, please indicate the condition of the Furniture (e.g., chairs, whiteboards, desks) by select the appropriate answer. *

- ◯ Very Good = 5 = جيد جدًا
- ◯ Good = 4 = جيد
- ◯ Average = 3 = متوسط
- ◯ Bad = 2 = سيء
- ◯ Very Bad = 1 = سيء جدًا

من خلال تجربتك، يرجى الإشارة إلى حالة نظام التدفئة والتهوية وتكييف الهواء وجودة الهواء الداخلي (مثل الأداء ودرجة الحرارة المحددة في المواسم الانتقالية ومواسم الصيف) من خلال اختيار الإجابة المناسبة
In your experience, please indicate the condition of the HVAC and Indoor air quality system (like performance and temperature set in transition seasons and summer seasons) by select the appropriate answer. *

- Very Good = 5 = جيد جدًا
- Good = 4 = جيد
- Average = 3 = متوسط
- Bad = 2 = سيء
- Very Bad = 1 = سيء جدًا

من خلال تجربتك، يرجى الإشارة إلى حالة الأنظمة الكهربائية (على سبيل المثال، كفاية الإضاءة الاصطناعية، ووظائف المنافذ والمفاتيح) من خلال اختيار الإجابة المناسبة
In your experience, please indicate the condition of the Electrical Systems (e.g., adequacy of artificial lighting, functionality of outlets and switches) by select the appropriate answer. *

- Very Good = 5 = جيد جدًا
- Good = 4 = جيد
- Average = 3 = متوسط
- Bad = 2 = سيء
- Very Bad = 1 = سيء جدًا

من خلال تجربتك، يرجى الإشارة إلى حالة المصعد (التوافر و وقت التوقف مثل تكرار الخروج من الخدمة) من خلال اختيار الإجابة المناسبة
In your experience, please indicate the condition of the Elevator (availability and downtime e.g., frequency of out-of-service) by select the appropriate answer. *

- Very Good = 5 = جيد جدًا
- Good = 4 = جيد
- Average = 3 = متوسط

- ◯ Bad = 2 = سيء
- ◯ Very Bad = 1 = سيء جدًا

من خلال تجربتك، يرجى الإشارة إلى الصحة البيئية والنظافة (نظافة الارضيات، الزجاج، دورات المياه، والتعقيم المستمر) من خلال اختيار الإجابة المناسبة
In your experience, please indicate the condition of the Environmental sanitation and cleanliness (Cleaning floors, glass, toilets, and continuous sterilization) by select the appropriate answer. *

- ◯ Very Good = 5 = جيد جدًا
- ◯ Good = 4 = جيد
- ◯ Average = 3 = متوسط
- ◯ Bad = 2 = سيء
- ◯ Very Bad = 1 = سيء جدًا

من خلال تجربتك، يرجى الإشارة إلى حالة إمدادات المياه (على سبيل المثال، التوافر، واتساق الضغط، والجودة، وصيانة التركيبات) من خلال اختيار الإجابة المناسبة
In your experience, please indicate the condition of the Water Supply (e.g., availability, pressure consistency, quality, and maintenance of fixtures) by select the appropriate answer. *

- ◯ Very Good = 5 = جيد جدًا
- ◯ Good = 4 = جيد
- ◯ Average = 3 = متوسط
- ◯ Bad = 2 = سيء
- ◯ Very Bad = 1 = سيء جدًا

من خلال تجربتك، يرجى الإشارة إلى حالة تصريف مياه الأمطار (على سبيل المثال، الفعالية في منع تراكم المياه، والقدرة أثناء هطول الأمطار الغزيرة) من خلال اختيار الإجابة المناسبة
In your experience, please indicate the condition of the Rainwater Drainage (e.g., effectiveness in preventing water accumulation, and capacity during heavy rainfall) by select the appropriate answer. *

- ◯ Very Good = 5 = جيد جدًا
- ◯ Good = 4 = جيد
- ◯ Average = 3 = متوسط
- ◯ Bad = 2 = سيء
- ◯ Very Bad = 1 = سيء جدًا

من خلال تجربتك، إلى أي مدى تتفق على أن حالة مبنى كلية الهندسة جيد الصيانة وحالته ممتازة؟ من خلال اختيار الإجابة المناسبة
In your experience, to what extent do you agree that the condition of the engineering college building in is well-maintained and in excellent condition? by select the appropriate answer. *

- ◯ Very Good = 5 = جيد جدًا
- ◯ Good = 4 = جيد
- ◯ Average = 3 = متوسط
- ◯ Bad = 2 = سيء
- ◯ Very Bad = 1 = سيء جدًا

قسم ج: العوامل المؤثرة على ممارسات الصيانة لعناصر مبنى كلية الهندسة في جامعة حائل
Section C: Factors Affecting the Maintenance Practices on the elements of engineering college building

في هذا القسم، يرجى تحديد الإجابة الأكثر ملاءمة لكل من أسئلة العوامل التي تؤثر على ممارسات الصيانة أدناه. حيث: (1)=التأثير منخفض جدًا، (2)=التأثير منخفض، (3)= التأثير متوسط، (4)=التأثير مرتفع، (5)=التأثير مرتفع جدًا
In this section, please select the most proper response of each FACTOR questions affecting maintenance practices in the below.
Where: Very Low Affect=(1), Low Affect=(2), Average Affect=(3), High Affect=(4), Very High Affect=(5)

بناءً على تجربتك، إلى أي مدى يؤثر تأخر وقت الاستجابة لطلبات الصيانة على مبنى كلية الهندسة؟ من خلال اختيار الإجابة المناسبة
Based on your experience, to what extent does the Delayed response time to maintenance requests affect on engineering college building? by select the appropriate answer: *

- ◯ Very High Affect = 5 = تأثير مرتفع جدًا
- ◯ High Affect = 4 = تأثير مرتفع
- ◯ Average Affect = 3 = تأثير متوسط
- ◯ Low Affect = 2 = تأثير منخفض
- ◯ Very Low Affect = 1 = تأثير منخفض جدًا

بناءً على تجربتك، إلى أي مدى يؤثر عدم وجود تقييم لرضا المستخدم أو تدابير تقييم الجودة على أعمال الصيانة في مبنى كلية الهندسة؟ من خلال اختيار الإجابة المناسبة
Based on your experience, to what extent does the Absence of user satisfaction evaluation or quality assessment measures affect on maintenance practices in engineering college building? by select the appropriate answer: *

- ◯ Very High Affect = 5 = تأثير مرتفع جدًا
- ◯ High Affect = 4 = تأثير مرتفع
- ◯ Average Affect = 3 = تأثير متوسط
- ◯ Low Affect = 2 = تأثير منخفض
- ◯ Very Low Affect = 1 = تأثير منخفض جدًا

بناءً على تجربتك، إلى أي مدى يؤثر عدم وجود موظفو صيانة مهرة على أعمال الصيانة في مبنى كلية الهندسة؟ من خلال اختيار الإجابة المناسبة
Based on your experience, to what extent does the Unskilled maintenance personnel affect on maintenance practices in engineering college building? by select the appropriate answer: *

- ◯ Very High Affect = 5 = تأثير مرتفع جدًا
- ◯ High Affect = 4 = تأثير مرتفع
- ◯ Average Affect = 3 = تأثير متوسط
- ◯ Low Affect = 2 = تأثير منخفض
- ◯ Very Low Affect = 1 = تأثير منخفض جدًا

بناءً على تجربتك، إلى أي مدى يؤثر الاستخدام غير السليم أو سوء استخدام مرافق المبنى على أعمال الصيانة في مبنى كلية الهندسة؟ من خلال اختيار الإجابة المناسبة
Based on your experience, to what extent does the Improper use or misuse of building facilities affect on maintenance practices in engineering college building? by select the appropriate answer: *

- ◯ Very High Affect = 5 = تأثير مرتفع جدًا
- ◯ High Affect = 4 = تأثير مرتفع
- ◯ Average Affect = 3 = تأثير متوسط
- ◯ Low Affect = 2 = تأثير منخفض
- ◯ Very Low Affect = 1 = تأثير منخفض جدًا

بناءً على تجربتك، إلى أي مدى تؤثر الكثافة العالية للمستخدمين والاستخدام المفرط للمساحات على أعمال الصيانة في مبنى كلية الهندسة؟ من خلال اختيار الإجابة المناسبة
Based on your experience, to what extent does the High occupant density and overutilization of space affect on maintenance practices in engineering college building? by select the appropriate answer: *

- ◯ Very High Affect = 5 = تأثير مرتفع جدًا
- ◯ High Affect = 4 = تأثير مرتفع
- ◯ Average Affect = 3 = تأثير متوسط
- ◯ Low Affect = 2 = تأثير منخفض
- ◯ Very Low Affect = 1 = تأثير منخفض جدًا

بناءً على تجربتك، إلى أي مدى تؤثر قلة الفحص المنتظم والصيانة المخططة على مبنى كلية الهندسة؟ من خلال اختيار الإجابة المناسبة

Based on your experience, to what extent does the lack of regular inspection and planned maintenance affect on engineering college building? by select the appropriate answer:

*****

- ◯ Very High Affect = 5 = تأثير مرتفع جدًا
- ◯ High Affect = 4 = تأثير مرتفع
- ◯ Average Affect = 3 = تأثير متوسط
- ◯ Low Affect = 2 = تأثير منخفض
- ◯ Very Low Affect = 1 = تأثير منخفض جدًا

قسم ج2: العوامل المؤثرة على ممارسات الصيانة لعناصر مبنى كلية الهندسة في جامعة حائل
Section C2: Factors Affecting the Maintenance Practices on the elements of engineering college building

في هذا القسم، يرجى تحديد الإجابة الأكثر ملاءمة لكل من أسئلة العوامل التي تؤثر على ممارسات الصيانة أدناه. حيث: (1)=التأثير منخفض جدًا، (2)=التأثير منخفض، (3)= التأثير متوسط، (4)=التأثير مرتفع، (5)=التأثير مرتفع جدًا
In this section, please select the most proper response of each FACTOR questions affecting maintenance practices in the below.
Where: Very Low Affect=(1), Low Affect=(2), Average Affect=(3), High Affect=(4), Very High Affect=(5)

هذا القسم مخصص لموظفو الصيانة - This Section ONLY for Maintenance Personnel

بناءً على تجربتك، إلى أي مدى تؤثر أخطاء في التصميم اوعيوب في البناء على أعمال الصيانة في مبنى كلية الهندسة؟ من خلال اختيار الإجابة المناسبة
Based on your experience, to what extent does the Faulty Design and construction errors affect on maintenance practices in engineerin college building? by select the appropriate answer: *

- ◯ تأثير مرتفع جدًا = 5 = Very High Affect
- ◯ تأثير مرتفع = 4 = High Affect
- ◯ تأثير متوسط = 3 = Average Affect
- ◯ تأثير منخفض = 2 = Low Affect
- ◯ تأثير منخفض جدًا = 1 = Very Low Affect

بناءً على تجربتك، إلى أي مدى يؤثر عمر المبنى على أعمال الصيانة في مبنى كلية الهندسة؟ من خلال اختيار الإجابة المناسبة
Based on your experience, to what extent does the building age affect on maintenance practices in engineering college building? by select the appropriate answer: *

- ◯ تأثير مرتفع جدًا = 5 = Very High Affect
- ◯ تأثير مرتفع = 4 = High Affect
- ◯ تأثير متوسط = 3 = Average Affect
- ◯ تأثير منخفض = 2 = Low Affect
- ◯ تأثير منخفض جدًا = 1 = Very Low Affect

بناءً على تجربتك، إلى أي مدى يؤثر عدم توفر موظفي صيانة ذوي المهارات على أعمال الصيانة في مبنى كلية الهندسة؟ من خلال اختيار الإجابة المناسبة
Based on your experience, to what extent does the Unavailability of Skilled Maintenance Personnel affect on maintenance practices in engineering college building? by select the appropriate answer: *

- ◯ Very High Affect = 5 = تأثير مرتفع جدًا
- ◯ High Affect = 4 = تأثير مرتفع
- ◯ Average Affect = 3 = تأثير متوسط
- ◯ Low Affect = 2 = تأثير منخفض
- ◯ Very Low Affect = 1 = تأثير منخفض جدًا

بناءً على تجربتك، إلى أي مدى يؤثر عدم دقة المخططات (كما تم بناؤه) على أعمال الصيانة في مبنى كلية الهندسة؟ من خلال اختيار الإجابة المناسبة
Based on your experience, to what extent does the Inaccurate As-Built Drawings affect on maintenance practices in engineering college building? by select the appropriate answer: *

- ◯ Very High Affect = 5 = تأثير مرتفع جدًا
- ◯ High Affect = 4 = تأثير مرتفع
- ◯ Average Affect = 3 = تأثير متوسط
- ◯ Low Affect = 2 = تأثير منخفض
- ◯ Very Low Affect = 1 = تأثير منخفض جدًا

بناءً على تجربتك، إلى أي مدى يؤثر نقص التمويل على أعمال الصيانة في مبنى كلية الهندسة؟ من خلال اختيار الإجابة المناسبة
Based on your experience, to what extent does the Lack of Funding affect on maintenance practices in engineering college building? by select the appropriate answer: *

- ◯ Very High Affect = 5 = تأثير مرتفع جدًا
- ◯ High Affect = 4 = تأثير مرتفع
- ◯ Average Affect = 3 = تأثير متوسط

- ◯ Low Affect = 2 = تأثير منخفض
- ◯ Very Low Affect = 1 = تأثير منخفض جدًا

بناءً على تجربتك، إلى أي مدى يؤثر عدم تبني نمذجة معلومات البناء على أعمال الصيانة في مبنى كلية الهندسة؟ من خلال اختيار الإجابة المناسبة
Based on your experience, to what extent does the Lack of Adoption of Building Information Modeling (BIM) affect on maintenance practices in engineering college building? by select the appropriate answer: *

- ◯ Very High Affect = 5 = تأثير مرتفع جدًا
- ◯ High Affect = 4 = تأثير مرتفع
- ◯ Average Affect = 3 = تأثير متوسط
- ◯ Low Affect = 2 = تأثير منخفض
- ◯ Very Low Affect = 1 = تأثير منخفض جدًا

سؤال مقابلة
Interview Question

برأيك، فضّلا صف مدى فعالية ممارسات الصيانة الحالية المطبقة على مبنى كلية الهندسة بجامعة حائل، وما هي العوامل التي تعتقد أنها الأكثر تأثيراً...
In your opinion, kindly descripe how effective are the current maintenance practices implemented on engineering college building at the University of Hail, and What factors do you believe have the most significant affect... *